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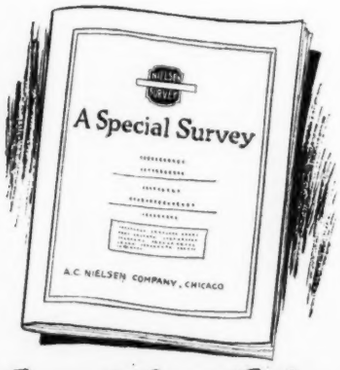

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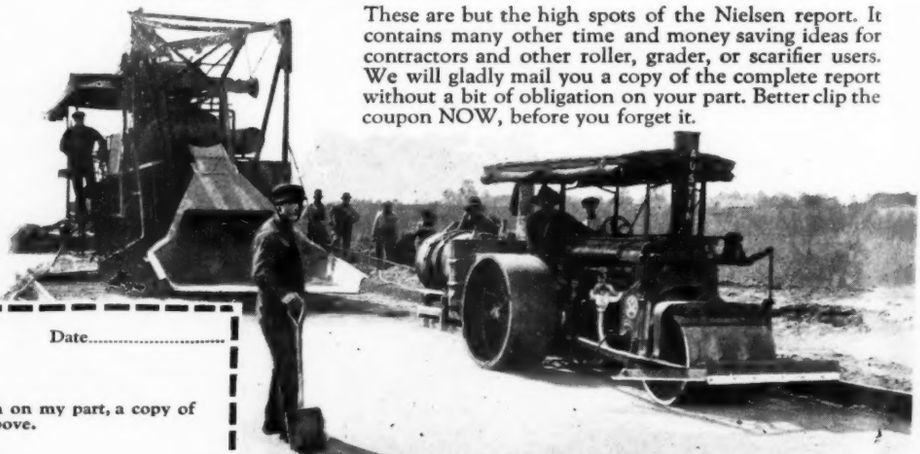

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VOL. 55 NO. 1

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Pipe Lines on Bridges

Details in Designs of Arch and Concrete Girder Bridges to Provide for Carrying Pipe Lines and Other Public Utility Conduits

By P. L. Brockway
City Engineer of Wichita, Kan.

Having observed the practical difficulties encountered in crossing city bridges with various ducts and pipe lines, special consideration was given this feature in the design of a reinforced concrete bridge for the city of Wichita, Kansas.

The bridge is a seven-span barrel-arch structure, 422 feet long between faces of the abutments. All pier tops are at the same elevation. Spans are variable in length, increasing by increments of four feet from each end to the center. All arches are exactly similar in section, so that the increasing length toward the center provides the camber necessary for good appearance.

The roadway is thirty-six feet between curbs, with a six-foot walk on each side. Paving is supported in the usual way by spandrel filling.

The unusual feature consists of the construction of double spandrel walls on each side of the roadway. The outside wall in each case is twelve inches thick with the outer face set six inches in on the arch and with a coping of the same projection under the handrail. The inside wall is eight inches thick set directly under the curb at the edge of the roadway, the top of the wall being finished and forming the curb. Both walls are fixed to the arch by steel dowels set when the arch was poured and both are reinforced with a cross grid of ¾-inch and ½-inch round rods. (The construction is indicated clearly by the drawings on the next page.)

The two walls are tied together and braced by concrete curtain walls eight inches thick, spaced eight feet from center to center, beginning about one foot from the ends of the spandrels adjacent to each pier. The extreme height of the spandrel walls at the skewback is sixteen feet. The cross walls are carried up to an elevation uniformly two feet under the lower side of the sidewalk slab, which is in turn supported across the two spandrel walls and constructed as an integral structure with them.

Spandrel filling between the walls, under the sidewalk, is carried up to within six feet of the sidewalk. The elevations are so fixed that the minimum clearance between the crown of the arch and the sidewalk slab is eighteen inches.

The result is that there is a clear space five feet wide and eighteen inches to two feet high under each walk the entire length of the bridge, with supports on a uniform grade at frequent intervals, and with plenty of room for a man to stand for about half the entire length. Cast iron plates two feet by five feet are placed in each walk over each pier to provide easy access to the tunnels. These were placed with the greatest dimension across the walk. They should have been placed the other way to permit more readily the shoving of long pipes through them under the walk.

An eight-inch and a twelve-inch pipe line were placed in one side as the bridge was completed. Half of each line was coupled up a joint at a time and shoved in on rollers on planks from each end of the bridge and the ends coupled in place in the center. No trouble was experienced in this installation.

Longitudinal and transverse sections (Figures 1 and 3) show the layout. A pylon was built on each end of each pier having a horizontal section as shown in Figure 2. Each pylon consisted essentially of short sections of the two spandrel walls across the pier, these sections being made thicker to allow an expansion grove to be built in each end to receive the thinner walls on the arch. These two sections are connected by a cross wall a foot thick, making a heavy H shaped column.

The heavier outer spandrel wall with its projection was made an architectural feature of the bridge, being surmounted by a massive post in the hand rail as shown in the photograph.

One unexpected benefit arising from this type of construction was the possibility of completing the entire structure over each span except for pavement, without having to wait for the spandrel filling to settle and indeed without any spandrel filling at all. The contractor was therefore able to continue right through two periods

of high water. In fact, the hand rail was finished so close at the close of the second period, that the bridge appeared like a completed structure which had partly been washed away.

One minor difficulty has developed. The relatively thin sidewalk slab is subject to considerably more temperature variation than the walls and arch supporting it. This has resulted in the development of a number of checks and occasional cracks. Heavy reinforcement has prevented these from occurring where they would be structurally dangerous.

This could be avoided easily by setting one edge of the walk in a seat built into the top of one of the spandrel walls, breaking the bond with a layer of tar paper or thin strip of asphalt joint. In fact, it might even be advisable to seat the walk slab in this way along both edges and cut it across into blocks which could be lifted out entirely if an unusually heavy pipe is to be installed. They could then be set back into place and surfaced up with iron wedges, pouring the cracks at each edge full of a bituminous compound and allowing it to flow under the walk where it is supported. This would prevent the entire destruction and reconstruction of the walk, such as was necessary to permit the installation of two sixteen-inch cast iron mains under a walk on an adjoining arch bridge with the usual spandrel fill supporting the walk.

A similar idea is being incorporated in the design of a reinforced concrete deck girder bridge. This bridge also will have variable-length spans with the bottoms of the girders all

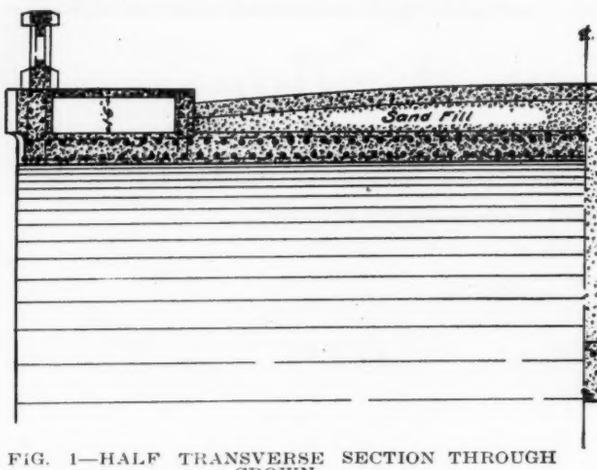
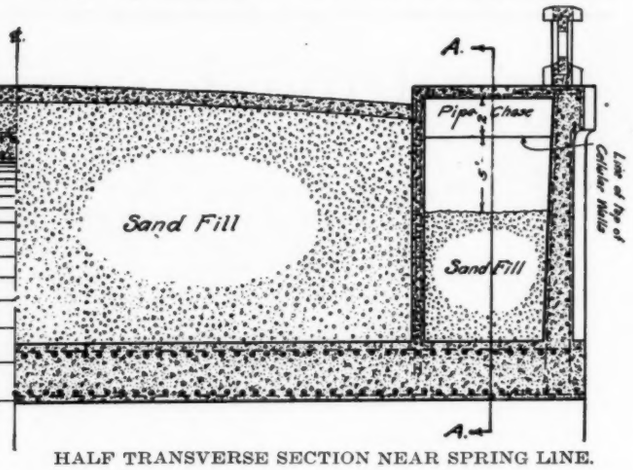


FIG. 1—HALF TRANSVERSE SECTION THROUGH CROWN.



HALF TRANSVERSE SECTION NEAR SPRING LINE.

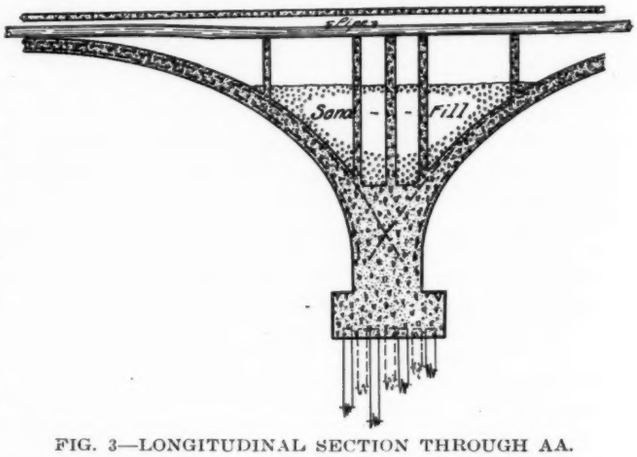
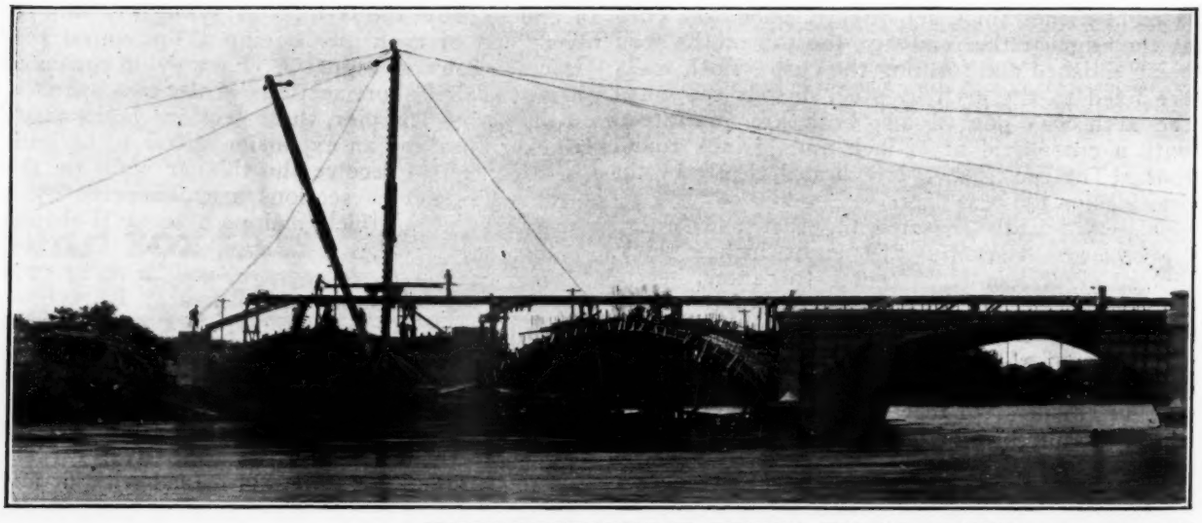


FIG. 3—LONGITUDINAL SECTION THROUGH AA.



MAPLE STREET BRIDGE, WICHITA, KANSAS, SHOWING THE SEVERAL

at the same elevation. The girders will vary in depth from 3.5 to 6 feet, which, as in the arch bridges, will give camber to the structure as a whole. Concrete cross braces between the outside girders will be placed at approximately ten-foot centers, with the lower edge a few inches above the bottom of the girders and the upper edge two feet below the sidewalk slab. These braces will serve the double purpose of sway bracing the deep girders and providing supports for pipe lines which will be concealed and protected from the weather. Access will be by cast cover plates over openings in the sidewalk slab. The sidewalk girders will be made of the same carrying capacity as those under the roadway, to allow for the installation of heavy mains.

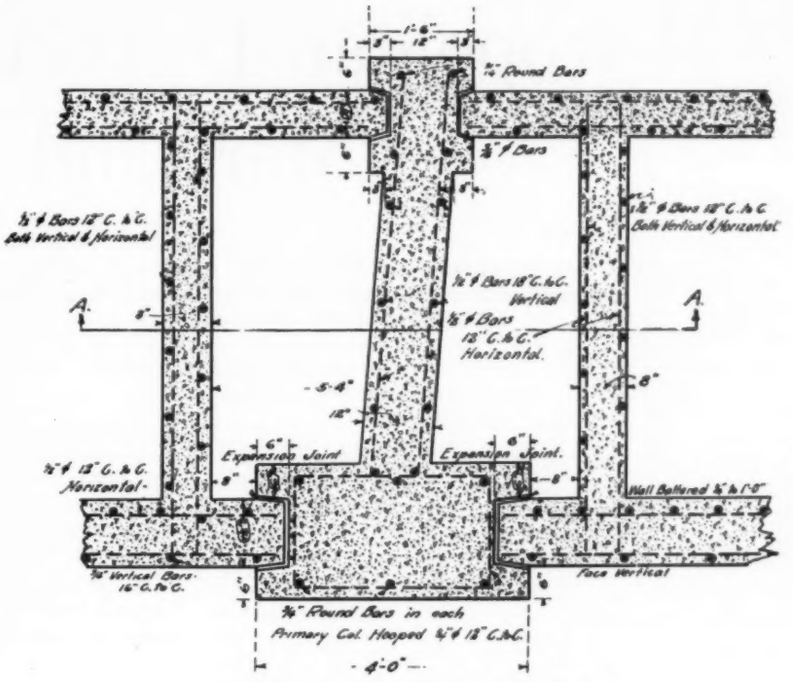
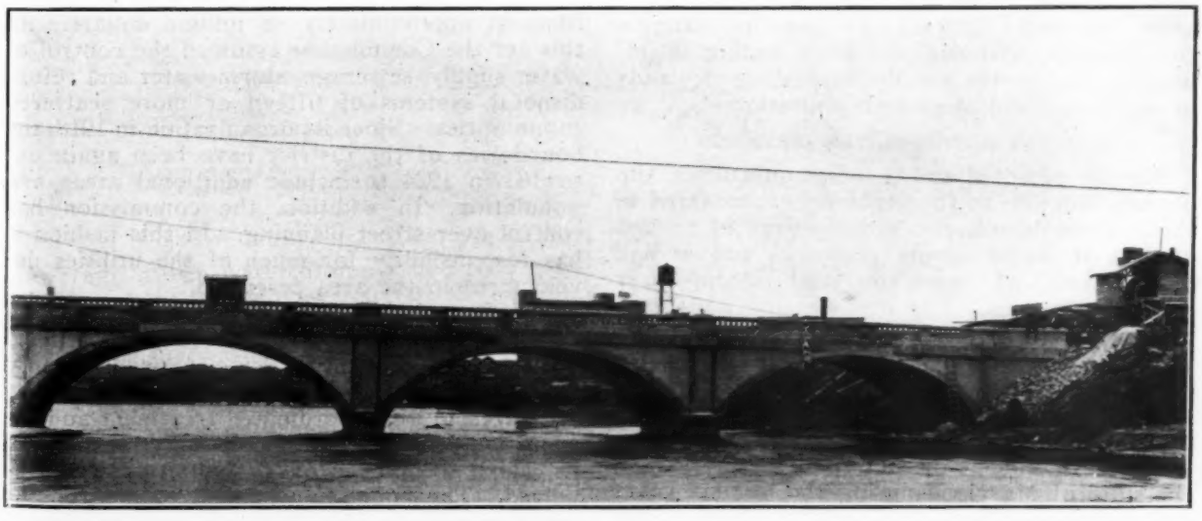


FIG. 2—HORIZONTAL SECTION THROUGH PYLON.

Street Cleaning in St. Paul

At the beginning of 1923 the city of St. Paul, Minn., had 133 miles of paved streets, or about 3,000,000 square yards. Of this area, 1,365,000 square yards was being cleaned by hand sweeping under the patrol system, each sweeper having a district varying from 3,200 square yards in the business district to 17,000 square yards in the residential sections. In addition to the sweeping service, all paved streets were cleaned with water periodically, using Studebaker flushers and auto flushers. In the retail district 7 miles of paved streets, or an area of 146,400 square yards, was flushed every night, while in the outlying districts flushing was done as required. Two new combination flushers and sprinklers had been added to the equipment at a cost of $17,955.

Sprinkling was done on 184 miles of streets at a rate of 9.8c., or $3.92 for a 40-foot lot, for four trips a day. 188 miles was treated with oil, two oilings per season for an average width of 24 feet, the rate being 6.72c. or $2.70 per 40-foot lot. The oil was distributed by Kinney auto oilers, which used 718,642 gallons of road oil. During the previous year a radical change was made in the sprinkling service. In July all street sprinkling of paved streets was stopped and the dust removed by more frequent flushing. The Corporation Council ruled that where flushing was done for the purpose of laying dust it could be assessed the same as sprinkling.



ARCHES IN THE VARIOUS STAGES OF CONSTRUCTION.

Metropolitan District Plans in Maryland

Districts organized for joint water supply, sewerage and refuse disposal systems, under the encouragement of the State Department of Health.

By Abel Wolman*

INTRODUCTORY

For some years in the past the State Department of Health of Maryland has been concerned with the development of adequate water supply, sewerage and refuse disposal facilities for various communities in this state. As the activities of the Bureau developed along these lines, it became apparent to the officials responsible for the operations of the Department that many of the difficulties experienced in obtaining adequate sanitary equipment for the smaller communities could be obviated by the consolidation of natural and financial resources of those communities which were located, geographically and politically, so as to take advantage of cooperative ownership and management of public utilities. Careful studies of local problems in various sections of the state indicated certain favorable areas which would lend themselves to careful planning for provision of joint water supply, sewerage, storm-water and refuse disposal systems.

In many cases these areas consisted of scattered communities ranging in size from several hundred to several thousand in population. Many of these were unincorporated, with private water supplies and with no provision of any kind for the disposal of domestic wastes. Others were struggling with inadequate and, in many cases, unsafe water supply and sewerage systems. Virtually all were in a continual struggle for financial existence and were finding it impossible to provide for the increasing demands of population and of modern sanitation.

EXISTING METROPOLITAN DISTRICTS

Barring personal and political difficulties, the obvious solution to the problems encountered in these areas lay in the development of unified control of water supply resources and unified development of sewerage and storm-water drainage systems. The organization and functioning of sanitary or metropoliatn districts appeared to offer an intelligent method of control of situations having many engineering similarities, but many local complications as to jurisdiction and as to financing.

The development of metropolitan districts in the state of Maryland during the last six years has occasioned some comment, in view of the fairly large proportion of the population of rural Maryland which is now under metropolitan control, in comparison with similar populations in other states which are still struggling in individual areas to cope with the same problems. In view of these circumstances, the writer has accepted the invitation of the Editor of PUBLIC WORKS to describe briefly some of the phases of metropolitan district planning in Maryland, with which the State Department of Health and other bodies have been concerned for some years in the past.

As early as twelve years ago Robert B. Morse, then chief engineer of the State Department of Health, gave considerable thought to the sanitary difficulties confronting the Department in certain areas and their solution by coordinated control. In Montgomery and Prince George's Counties, as a result of his observations and efforts, supported by a group of residents in this area with vision and energy, the first metropolitan district, known as the Washington Suburban Sanitary District, was authorized by legislative act in 1918. This act authorized the formation of the Washington Suburban Sanitary District under the jurisdiction of the Washington Suburban Sanitary Commission. The Commission was granted jurisdiction for sanitary purposes over an area of 95 square miles with a present population of 40,000 and a taxable basis of approximately 45 million dollars. By this act the Commission assumed the control of water supply, sewerage, storm-water and refuse disposal systems of fifteen or more scattered communities. Since its organization in 1918, the boundaries of the district have been again extended in 1924 to include additional areas and population. In addition, the commission has control over street planning. In this fashion it has responsibility for much of the utilities development in the area described.

In 1922 a similar organization was authorized by legislative enactment in Anne Arundel County, known as the Anne Arundel County Sanitary Commission. This Commission was organized to give coordinated treatment and cooperative control to a difficult sanitary situation in which a number of communities were involved. The population subject to control, for sanitary purposes, by the Anne Arundel County Commission is in the neighborhood of 10,000

*Chief Engineer, Maryland State Department of Health.

and the area affected may cover a considerable part of Anne Arundel County. At the present writing the Commission has already made provision for water and sewer facilities for a population approximating 5,000, over an area of five square miles. As time goes on its activities will include wider areas, as authorized by law.

In 1924 the Baltimore County Metropolitan District was organized, also by legislative enactment, in order to provide water supply, sewerage and storm-water facilities for the rapidly increasing population in Baltimore County, contiguous to Baltimore City. This district includes a present population of almost 55,000 and embraces an area approximating 197 square miles.

The present taxable basis of the Baltimore County Metropolitan District is 83 million dollars. The district covers a territory containing excellent developments, which have been retarded by the absence of adequate sanitary facilities. This unfortunate situation arose from the fact that there were no incorporated communities in Baltimore County, so that the provision of water supply and sewerage facilities was made increasingly difficult.

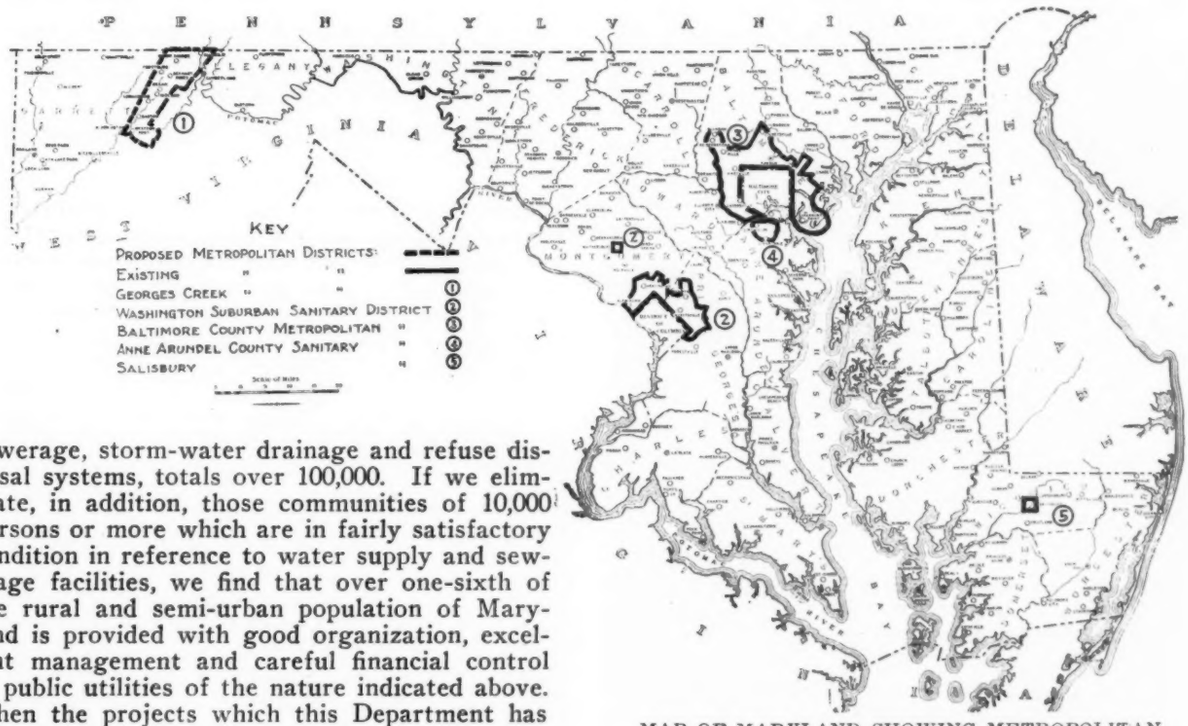
In this same year a water and sewerage commission was authorized by the Maryland Assembly in the City of Salisbury, with a population of 10,000, and an assessable basis of 10 million dollars. The Salisbury Water and Sewerage Commission was granted power to extend its facilities to territories beyond the city limits, and the front-foot assessment method for payment of such extensions is authorized by law.

The total population in Maryland, exclusive of Baltimore City, which is now under unified or metropolitan management, for water supply, sewerage, storm-water drainage and refuse disposal systems, totals over 100,000. If we eliminate, in addition, those communities of 10,000 persons or more which are in fairly satisfactory condition in reference to water supply and sewerage facilities, we find that over one-sixth of the rural and semi-urban population of Maryland is provided with good organization, excellent management and careful financial control of public utilities of the nature indicated above. When the projects which this Department has still in mind are completed in later years, the total populations in rural or semi-urban areas in Maryland that are not under metropolitan control will include virtually only scattered communities aggregating hundreds of single units which are too far away from each other to be included in the program for pooling of resources.

OTHER JOINT PROJECTS

In this connection some reference should be made also to the unusual number of joint undertakings which have been proposed in the state of Maryland in recent years, which add to the populations actually under cooperative management. Upon the completion of the new water supply for the city of Hagerstown from the Potomac river, it is probable that the town of Williamsport will obtain its filtered drinking water from the Hagerstown supply main. The Tuberculosis Sanatorium for the Colored at Henryton obtains its entire supply of filtered water from the Springfield State Hospital for the Insane through a pipe line connecting the two institutions, covering a distance of three miles. The economy of this undertaking has confirmed the wisdom of the original plan proposed by Mr. Morse when chief engineer of this Department. The Maryland School for Boys in the near future will probably obtain its water supply from the supply tunnel of the City of Baltimore in the vicinity of the Loch Raven dam.

In addition, a metropolitan district has been proposed by this Department for the Georges creek area in Allegany county. This is an area covering much of the coal mining territory of western Maryland, including a population of



MAP OF MARYLAND SHOWING METROPOLITAN DISTRICTS.

approximately 30,000 and an area of almost 90 square miles. Although the development of the program in this area has not yet reached successful completion, the recent proposal of the West Virginia Pulp and Paper Company to organize a private water company in the lower section of this area, to provide filtered water for Bloomington, Piedmont, Luke, Westernport and the West Virginia Pulp and Paper Mill, should carry forward the metropolitan plan in part, if not in whole. The success of the private water company undertaking, which is proposed as a cooperative arrangement in the form of a company with no profit-making purposes, will provide an excellent filtered drinking water supply for approximately 10,000 persons now supplied, for the most part, with an inadequate and unsatisfactory series of water supply systems.

Several other minor cooperative undertakings have been presented to various communities by this Department, but have not progressed sufficiently far to warrant discussion at this time.

FORM OF ORGANIZATION

The form of organization provided in these districts differs materially in the various areas, due to periods at which these districts were organized and to the psychology of the public at the particular time and place. In the Washington Suburban Sanital District the commission consists of three persons, one appointed by the county commissioners of each county involved, upon recommendation by the State Board of Health, and one by the Governor of the state. In the Anne Arundel County Sanitary Commission, two are appointed by the county and one by the State Board of Health. In 1924, however, amendments to the Anne Arundel County Sanitary Commission law provide for the appointment of the three commissioners by the county commissioners. In the Baltimore County District the three county commissioners sit on designated days each week as the Metropolitan Commission. This District will obtain water from the Baltimore City public supply and will use Baltimore City main sewers wherever possible, upon certain agreements as to price and quantity. In the Salisbury Water and Sewerage Commission, the three commissioners were named in the bill authorizing the formation of the Commission. Interesting as the details of the programs developed in each of these areas are, it hardly appears to the writer that this is the proper place to elaborate them, particularly since the operations in some of the districts are to be described shortly by the officials of those districts.

METHOD OF FINANCING

It is well to indicate, however, at this point, that the method of financing in each of these cases and in many of the local water supply and sewerage programs with which this Department has been concerned, have been patterned fairly closely upon the scheme in use in the Washington Suburban Sanitary District. This plan was inaugurated by Mr. Morse when he assumed direct charge of the operation in that district, as chief engineer of the Washington Suburban Sanitary District. In brief, the financing plan provides for the accumulation of funds from taxes, special assessments and service rates. The special assessments are developed on the front-foot basis and provide for the fixed charges on the water and sewer lines which are a direct benefit to the abutting property. The increase in tax rate covers approximately the fixed charges on the cost of reservoirs, pumping plants, purification units and excess size mains, which may be assumed to be community benefits. The service rates are established to provide for the maintenance and operation charges involved in the proper conduct of the systems. This plan of financing seems to meet the various requirements of the many situations encountered with the greatest degree of equity and justice to all the parties involved in the program, and has been used with considerable success by this Department in presenting programs of improvement to communities in the state.

The bond issues for such districts usually bring good sales values, as the bankers are anxious to obtain well-protected tax-free issues. The prices obtained for some of the issues are shown in Table 1.

TABLE I.

PRICES FOR METROPOLITAN DISTRICT BONDS.

A. Washington Suburban Sanitary District.

Date of Sale	Amount	Interest Per Cent	Maturity Years	Selling Price
August 14, 1918	$50,000	5	50	101.596
August 14, 1919	750,000	5	30-50	103.57
April 30, 1921	100,000	5	30-50	90.
June 28, 1921	41,000	5	30-50	97.
July 9, 1921	24,000	5	30-50	92.
August 8, 1921	75,000	5	30-50	89.
August 13, 1921	25,000	5	30-50	91.5
December 14, 1921	110,000	5	30-50	103.1467
February 1, 1922	250,000	5	30-50	102.229
June 6, 1922	500,000	4½	30-50	97.04
January 19, 1923	500 000	4½	30-50	98.10

Note—If the $500,000 issues of June, 1922, and January, 1923, had borne interest at the rate of 5 per cent, the equivalent selling prices would have been 107.7 and 108.9, respectively.

B. Baltimore County Metropolitan District.

Date of Sale	Amount	Interest	Maturity	Selling Price
June 23, 1924	$1,000,000	4½%	Serial	103.348
June 23, 1924	100,000	4½%	Serial	105.423

EXAMPLES OF CHARGES

That the system of co-operative control and management of sanitary facilities works out to the advantage of the individual has been amply demonstrated in that area which has been in operation the longest period of time, namely, the Washington Suburban Sanitary District. It is hardly necessary to discuss at length the figures shown in Table 2. When it has been possible to furnish to the average property water and sewerage facilities during the past five years at a total annual cost of $21 to $26 in these periods of unusual construction and material costs, it need hardly be argued that financially, at least, the wisdom of metropolitan district control has been amply confirmed. The obvious benefits to this Department and to the communities of having water supply and sewerage facilities under careful engineering supervision in three or four governmental units, instead of scattered through sixty to seventy incorporated and unincorporated settlements, indicate that the method

TABLE 2.

WASHINGTON SUBURBAN SANITARY DISTRICT.

Usual Water and Sewer Charges.

	1921		1924	
General tax, cents per $100 of assessed valuation	4		5	
Front-foot assessment (annual cents per foot)	Water	Sewer	Water	Sewer
Business or industrial, first 200 feet	14	8	16	14
All excess	7	4	8	7
Subdivision, first 150 feet	9	6	10	12
All excess	3	2	3	3
Small acreage, first 150 feet	9	6	10	12
Second 150 feet	3	2	3	3
All excess	1	1	1	1
Agricultural	9	6	10	12

(No assessment unless connected, length limited to 150 feet.)

Water connection $25 for ¾-in. connection, increased amounts for large sized connections.

Sewer connection $25, amounts payable in one sum or in four annual installments, the deferred payments bearing interest at 6 per cent.

Water service charge, $4 annually for ⅝-in. meter, increased amounts for larger-sized meters.

Water consumption charge (includes sewerage service) for all water registered.

15c. per 1,000 gal., up to 25,000 gal. semi-annually.
14c. per 1,000 gal., next 25,000 gal. semi-annually.
13c. per 1,000 gal., next 100,000 gal. semi-annually.
11c. per 1,000 gal., 75,000 to 750,000 gal. quarterly.
9c. per 1,000 gal., 250,000 to 2,500,000 gal. monthly.
8c. per 1,000 gal. above 2,500,000 gal. monthly.

Examples

Description of property
$5,000 assessed value, 60 ft. frontage
40,000 gal. annual consumption

Tax		Assessment		Service Charge		Consumption		Total	
1921	1924	1921	1924	1921	1924	1921	1924	1921	1924
2.00	2.50	9.00	13.20	4.00	4.00	6.00	6.00	21.00	25.70

adopted as an ultimate desirable program appears more than favorable.

FUTURE LEGISLATION DESIRABILITIES

In order to facilitate the initiation of such programs in the future, the State Department of Health has made an effort on several occasions to provide for the enactment of a state-wide law which would permit of the organization of such districts, without special legislative enactment in each case and by submission of the question to popular referendum. In each case, however, this attempt at state-wide permissive legislation has failed, because there was considerable disinclination to grant local communities this right, without careful consideration of each individual situation separately. It is probable that some of these barriers may be removed as time goes on. In the meantime the Department is well satisfied with the progress which has been made in the past ten years in the development of this form of coordinated control of engineering facilities for sanitary purposes.

ACKNOWLEDGMENT

Obviously in the development of such programs as the above, a number of individuals and forces are always operative in carrying the programs to successful fruition. It is quite impossible to refer to each of these individuals by name, but I do wish to place on record the fact that many of the persons in public and political life in Maryland have been great assets in fostering these programs when their importance and feasibility have been made clear to them. Without their aid most of these programs would be matters of record and not of practice. This is an opportune time, also, to indicate the appreciation of the writer of the distinctly pioneer work which Robert B. Morse, the former chief engineer of this Department, carried out in initiating some of these programs in the earlier days of his office, when the sanitary conscience of the public was perhaps not as well developed as it is now.

University Heights Street Guides

University Heights, a restricted residential subdivision of University City, Mo., is believed to be the first community in that district to adopt illuminated street guides located at the centers of the streets. These were installed as mere location guides, since there is little traffic in the community requiring regulation.

Owing to the irregular street layout and abundance of shade trees, the usual unilluminated sign along the curb was found to be ineffective, particularly at night. The trustees, desiring to improve upon this practice, submitted the matter to the Terrell Croft Engineering Company of University City to design and supervise the installation of some suitable system. The design finally accepted resulted from suggestions made by officials of the Union Electric Light & Power Company, Ralf Toensfeldt of the St. Louis Lighting Department, the St. Louis Brass Company and the Banner Iron Works Company. Twelve guides on the design evolved have now been put

STREET NAME SIGNS IN CENTER OF STREET.

in service, the first trial sample having been in operation for more than a year.

Each post comprises a concrete base, cast-iron standard, and luminaire or lighting fixture. Current for operating was obtained from the series underground street lighting circuits of the Union Light & Power Company by means of an armored two-conductor cable carried underground from the street lighting cables just inside the curb.

The concrete base extends for 2 feet below the ground as a cylinder 4 feet in diameter and for 2 feet above at the top as a truncated cone. A hollow ornamental cast-iron column of standard design is fastened to the concrete base by means of four ¾-inch by 18-inch anchor bolts.

For the luminaire a special design was necessary, the one finally adopted being the outcome of many trials. It consists essentially of a hollow sheet and cast bronze box with sides and bottom open, glass street name panels being inserted in the sides and clear glass panels in the bottom. Over a circular opening in the top is fastened a 12-inch diameter hemispherical ruby glass bowl. At night the street names and ruby bowl are well lighted and present a pleasing appearance, while light is projected downward to illuminate the concrete base, which is painted white. The luminaire is held in an annular recess in the standard and may be rotated to any desired position and held there with set screws.

Each luminaire is equipped with two 40-candlepower, 6.6 ampere, nitrogen filled, series incandescent lamps, two being employed to minimize the possibility of a unit becoming dark. A sheet steel partition causes one-half of the luminaire to show decreased brilliancy in case one lamp should fail, thus giving information of the fact. A white enamelled sheet steel reflector in the top of each luminaire throws light downward on to the concrete base to make it plainly visible and minimize collisions with it.

The street names are in white letters on a ruby background, being etched through the ruby coating. The luminaire box is 20 inches square outside and 12 inches high and is set so that the center of the box is 7 feet 9 inches above the road surface, the cast-iron post being itself 5 feet 4 inches high. The letters etched on the plate are 3 inches high.

These posts, complete with their cable connections to the street curbs, are owned outright by the property holders in University Heights, which ownership is vested in the trustees. The light company which furnishes the energy is paid by the trustees for maintenance. Each post installed complete with cable and glassware cost approximately $148. Electric current and maintenance will cost about $2.75 per post per month.

Expensive Aggregate in Nevada

Ely, Nev., is anxious to build a concrete pavement through the city, in which it would be assisted by federal aid, but bids received on March 26th were practically double the estimates. The great difficulty was in securing sand and gravel suitable for first-class concrete work. A deposit nine miles from Ely which has been used for local work will not pass the standard test, and all the contractors bidding on the work calculated on shipping sand from Salt Lake City at a cost of $11 or $12 per cubic yard, while the long haul for gravel and expense for washing it brought the cost of this to $10 per cubic yard.

This lack of suitable aggregate affected not only paving but all other concrete work required in Ely and that part of the State. Recently the Highway Department sent a trained geologist into the field to endeavor to locate deposits, and he has discovered a large deposit of sand and gravel which meets all requirements, only 3½ miles from Ely, and it is believed that the material can be delivered on the work at a cost of probably $2 per ton. If this proves to be the case, it will, it is calculated, permit the construction of concrete pavements at half the bids received in March.

Care of Wire Ropes

Selection of drums and sheaves; layout of hoisting plant; installing rope; lubrication of rope.

The purchase, maintenance, and renewal of the wire ropes used by a contractor around derricks and other machinery employed by him form a no inconsiderable part of his outlay. Much of the cost for repairs and especially for renewals might often be avoided by careful and intelligent treatment of the rope. Instructions for such treatment were given by William Constable, a mechanical and electrical engineer with the Republic Iron and Steel Company, before the annual meeting of the Lake Superior Mining Institute. Some of the principal points of Mr. Constable's instructions are given below.

The use of a grooved drum is far better and more economical than a flat faced drum for wire rope, since, if the first coil of rope is not laid on exactly true, there will be distortion and abrasion of the rope whether the succeeding layers follow or do not follow in the grooves of the first layer. It is generally desirable to make the diameter of the drum not less than sixty times that of the rope.

Sheaves through which wire rope passes should be of material that will not wear rapidly with service, and any sheave that shows much wear should be at once discarded or the grooves remachined. This is especially desirable where a new rope is to be reeved through an old sheave, since a groove worn in the old sheave by an old rope will probably have slightly less width than that of the new rope and consequently bind the latter. In general, the groove diameter should be slightly larger than the rope diameter, the author recommending 1-16-inch excess diameter for ropes up to 1¼-inches, and ⅛-inch excess for those larger up to 2½-inches. The sheaves should be machined exactly round and in perfect balance to prevent sliding of the rope on the sheaves and consequent wear. The diameter of the

sheave is generally figured as seventy-two times the rope diameter, but the author recommends eighty times.

The fleet angle should not exceed 1½ degrees when a small diameter, straight-faced drum is used, as too large an angle results in overlapping of the rope on the drum. The fleet angle is the line made by two lines drawn from the center of the sheave, one of these to the middle of the drum and the other to the outermost wrap of the rope on the drum. The sheave in this case referred to is of course the first one which the rope enters after leaving the drum. The angle is controlled, for any given width of drum, by the distance from the drum to this first sheave.

In using clips for fastening wire rope around an eye or elsewhere, be sure that the U-bolt bears on the slack side of the rope. Otherwise a crimp is placed on the tension side of the rope which damages it at that point. Clips should be spaced so that the distance between the center line of clips is equal to six times the rope diameter. It is very important that the nuts be tightened frequently when the rope is first put into service.

When a rope is installed, care should be taken not to damage it in any way, nor cause it to become kinked. It must not be uncoiled like a hemp rope, but should be unrolled on the ground like a hoop and straightened out before it passes around the sheaves. If the rope has been received on a reel, this should be jacked up on a shaft and allowed to unwind slowly until the entire length of rope has been installed.

Avoid the rubbing of the rope on a steel boom by installing guide rollers, which should be kept well greased so as to revolve freely.

In manufacturing wire rope, great care is exercised to twist the wire in the strands and the strands in the rope under uniform tension. In order to preserve this condition, when a rope is cut, it is very important that the ends be properly secured beforehand with wire seizings. Three of these should generally be placed on each side of the cut. Annealed iron wire is used for this purpose.

Lubrication of a wire rope reduces internal and surface friction and prevents corrosion. It is especially desirable where the ropes are operated in water or in vapors or fumes. The lubricant should not be a thin one, but the best material is that which, when applied hot, is sufficiently thin to penetrate through rope, but when it cools will congeal into a plastic filler throughout the rope. Lubrication is especially necessary for a rope that is used over sheaves because of the internal friction caused by the bending in passing through the sheave.

Federal Water Power Investigations

The United States Geological Survey is planning to include in its work for 1924 extensive river surveys and water power and irrigation investigations in Idaho, Oregon, California, Utah, Colorado, Nevada, Arizona, Washington, Montana, Wyoming and New Mexico.

River surveys are made by the Topographic branch of the Geological Survey, which is probably the largest organization of topographical engineers in the world. River flow investigations are made by the Water Resources Branch, which contains 1600 gauging stations where the daily flow of rivers and canals in all parts of the country is measured. The geological formations at the dam and reservoir sites are examined and reported on by members of the Geological Branch. The results of these field investigations are studied by the Land Classification Branch, to discover what lands will probably be affected by water power development, and these are classified as power sites and are withdrawn from homestead entry. Finally, the Editorial and Map Making Divisions combine to publish the material collected by the four branches and make it available for public use. The maps are sold at moderate prices, while the reports are either published as water supply papers, or are available for public inspection at the district offices of the Geological Survey as well as the office in Washington, D. C.

California Highway Equipment Department

Job distribution of equipment costs. Equipment received from Federal government repaired and made over. Graders with rubber tires and roller bearings.

The Equipment Department of the California Highway Commission attends to the purchase, use and care of equipment employed in road construction operations throughout the state. It is one of the five major departments into which the headquarters administrative forces are divided. It is under the direction of R. H. Stalnaker, equipment engineer, who is assisted by three assistant equipment engineers and a chief clerk.

The headquarters shop forms a division of the Equipment Department, and this also is under the general supervision of Mr. Stalnaker, assisted by a shop superintendent, head of the store department, foreman of the truck department, foreman of the machine shop and heavy equipment section, and foreman of the service department.

One of the troublesome problems in the past has been an equitable distribution of the cost of the upkeep of equipment against the work on which it had been used. When the cost of overhauling was prorated against several jobs, each man who had used the truck insisted that he was responsible for none of the necessary overhauling, but that it should be charged against the others. The legislature had passed a law requiring that a charge for depreciation of equipment be made against all work performed by day labor. In order to comply with these requirements, it was finally decided to place all state highway equipment on a rental basis. Rentals are so fixed as to cover the average cost of repairs and upkeep and an allowance for depreciation based upon the estimated life of the equipment. This system was put into effect January 1st of this year and so far has succeeded beyond expectations.

The headquarters shop is located at Sacramento and has been pronounced one of the best equipped for its kind of work on the Pacific Coast. About 110 men are employed in the shop operations and the weekly payroll averages about $3200.

A large part of the equipment received has been war equipment obtained from the Federal Government. California has received about 1200 motor vehicles, 30 tractors, several carloads of picks and shovels, practically all the machine tools needed to equip the headquarters and division shops, several carloads of automobile and truck parts and a large quantity of miscellaneous supplies and machinery. In spite of the large number received, the Commission now has few trucks in storage and these will all be in service on state work within the next few weeks.

Much of this material has been repaired, made over or adapted to other purposes. An interesting illustration of the last is the use of a number of 8-cylinder Cadillac engines, originally obtained by the Government during the war for driving 2½-ton caterpillar tractors at high speed. Early in the year Mr. Stalnaker received a carload of Cadillac motors, radiators and spare parts from government stock at the Rock Island arsenal, which the California shop has utilized as the power for driving rock crushers, and four such power plants are in service in the Sacramento canyon. These power plants cost about $550 per plant including freight, and are said to be better than could be purchased in the open market for $2,000.

About a year ago an 18-ton steam roller was sent into the shop for overhauling. The boiler was found practically useless, and it was decided to alter the roller to a gasoline roller, and a 35-horsepower, 4-cylinder gasoline engine, received from the government, was installed at a cost less than that of repairing the boiler and steam engine, and has been very successful.

To prevent steel truck bodies from being sprung out of shape when used to haul rock in connection with heavy steam shovel operations, the shop has worked out a plan for reinforcing the body by use of heavy 3-inch oak planking placed beneath the body in such a way that it acts as a sort of bumper. Fifteen 3-yard trucks have been turned out, reinforced with planking and all equipped with underbody hydraulic hoists with a dumping angle of 48 degrees, which have proved very successful.

Previous to this spring, the Highway Commission has been purchasing graders in small lots and from various manufacturers. An investigation showed that graders used on shoulder work wear out faster when being pulled behind trucks to and from work than during the working period, as the steel wheels and plain wheel boxes will not stand up under even a moderate rate of speed, and that rubber tires and roller-bearing wheels would obviate many of the difficulties, and 1924 bids for graders call for 8-foot graders equipped with rubber tires and roller bearings. Also in order to systematize graders and effect a saving by wholesale purchase, bids were asked on 34 graders at one time. Nearly every standard grader manufacturer in the country bid, and an order was placed for the entire 34 graders with an apparent saving of about 15% through wholesale purchasing.

Black Base in New Jersey and Kansas

Cost, details of construction and reason for use in Yates Center and East Trenton

The use of a bituminous concrete or so-called "black" base under pavements of highways and city streets is by no means new in this country, being especially common on the Pacific Coast; but neither is it common practice in a majority of the states. In a paper published by the League of Kansas Municipalities, C. B. Bauerfeld, mayor of Yates Center, Kans., says that, finding that in the Pacific coast states there are 6,000 sq. yds. 30 years old, 3½ million sq. yds over 10 years old, and over 7 million laid last year, he did not see any reason, climatic or otherwise, why such base should not be as satisfactory in Kansas as there or as in Omaha, where it has been used for years, and his city is now using such construction. He describes the method of construction as follows:

"Thickness of such pavements can be adjusted to the traffic demands in each case and the price would vary accordingly, but this city is using a 3½-inch asphaltic concrete base and a 1½-inch sheet asphalt wearing surface at a contract price of $2.27 per square yard.

"The sub-base is first rolled to complete firmness. In places where the ground cannot be brought down to thorough compactness with a roller, crushed rock is rolled into the sub-base to overcome the spongy condition. This is necessary, as the pavement cannot be laid on an unstable sub-base. This is considered a factor of safety because failures of rigid pavements which temporarily bridge such places are often directly traceable to a neglect of the sub-base. Any amount of rolling necessary to perfect the sub-base is required by this city's specifications.

"The asphaltic concrete base is mixed in the

ASPHALTIC CONCRETE BASE AT YATES CENTER.
Shoveling from dumping board onto subgrade.

asphalt plant and rolled hot on this prepared sub-base. The final thickness is 3½ inches and a typical analysis of the mixture is as follows:

"Bitumen	5.4%
Sand and dust passing a 40 mesh sieve	33.3%
Sand passing a 4 mesh sieve and retained on a 40 mesh sieve	20.1%
Rock passing ¾" mesh sieve	22.5%
Rock between ¾" and 1"	18.7%
	100.0%

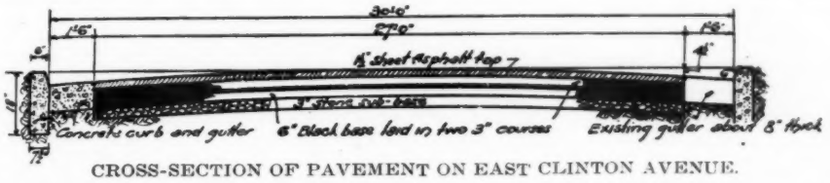
"Our city's specifications required that every 200 square yards must have at least 1 hour continuous rolling with a roller weighing not less than 8 tons, and that no more base could be laid in advance of the top than that sufficient to constitute a full day's run of sheet asphalt top.

"In laying the wearing surface, which was laid directly upon this black base previously described, the standard specifications of the Asphalt Association were used. The contractor, with the approval of the city council, purchased and used in this work a straight run Mexican asphalt, a typical analysis of which is as follows:

"Flash point, open cup	520°F.
Penetration, 100 G—5 sec. 77°F.	46
Loss @ 163° F—5 hours	0.03%
Melting point (ball and ring)	135°F.
Solubility in carbon bisulphide	99.9%
Ductility	100.0"

The base is laid one day, the top the next day, and the street thrown open to traffic the third day.

Mercer County, New Jersey, adopted black base on East Clinton Ave., East Trenton, largely because of this ability to use the street immediately after construction. The section to be paved connected two important roads and a large industrial plant abutted upon it on each side for nearly the entire length. This plant daily sent large tonnages of its product to the freight station by horse-drawn trucks. This seemed to call for a substantial foundation, and also for a method of construction that would not seriously interfere with the shipments by the plant, there being no other possible outlet from the plant except through this street. After canvassing the possible methods, it was decided to use black base on a sub-foundation of stone, the stone being obtained by excavating the old pot-holed macadam originally on the street. The above and the following description of the work are condensed from one written by H. F. Harris, county engineer of Mercer County.



CROSS-SECTION OF PAVEMENT ON EAST CLINTON AVENUE.

The macadam stone was piled with forks, the street graded to 10½ in. below the finished grade, and the stone returned, shaped, sprinkled and rolled, to a depth of 3 in.; this being done because it would be difficult otherwise to roll the sandy soil, also because it gave greater depth of foundation.

On this the asphaltic base was laid in two layers, each 3 inches thick after rolling, followed by a 1½-inch asphalt wearing surface. The following is a typical analysis of the asphaltic base material:

	Per cent	Per cent
Bitumen		6
Passing 200 mesh		2.7
Passing 100 mesh	4.2	
Passing 80 mesh	2.2	
Passing 50 mesh	4.9	
Passing 40 mesh	3.2	
Passing 30 mesh	2.6	
Passing 20 mesh	3.6	
Passing 10 mesh	4	
Passing ¼ mesh	2.4	27.1
Passing ½ mesh	7.4	
Passing ¾ mesh	27.6	
Passing 1¾ mesh	23.4	
Passing 1¼ mesh	5.8	64.2
Total		100

A typical analysis of the asphaltic cement used was:

	Per cent
Penetration of A. C.	46
Fixed carbon	15.3
Mineral matter	.05
Organic matter insoluble	.05
Bitumen	99.9
Total	100

The maximum length of time that traffic from the plant was suspended was 4 hours. The cost was $4.05 a square yard, of which 49 cts. was for excavation, 18 cts. for the subfoundation, $2.49 for the black base and 89 cts. for the sheet asphalt surface. Mr. Harris thinks it probable that "with contractors getting more familiar with the type of construction, the cost can be materially reduced."

The laboratory and plant inspection was under the supervision of Dow & Smith; James J. Barrett was the contractor, and the engineer in charge for the county was J. B. Walker.

Following this experience, the county entirely

EAST CLINTON AVENUE, EAST TRENTON.
De La Vergue Steam Turbine Plant on both sides.

reconstructed a section of stone road about 2 miles long, using black base. At hundred-foot intervals the location of the edge of the metal and its depth there and at the middle of the road were determined. This examination showed the road to average 16.7 feet wide (minimum 15.1 and maximum 18.9) and 8¾ inches deep (minimum 5½ and maximum 13). This old stone gave an excellent foundation and it was decided to use it, widening it where necessary, and placing a black base on it; as this would permit construction in a minimum length of time and at minimum cost, conserve to the utmost the original investment in the macadam pavement, cause least inconvenience to abutting property owners and give a thicker and heavier pavement than other construction.

The pavement was constructed 20 feet wide with a 3-foot penetration shoulder on each side. The widening of the base was effected by excavating, then placing and rolling macadam stone. At the same time the foundations for the penetration shoulders were placed and rolled, thus eliminating a line of weakness often found where newly constructed shoulders join a pavement already laid. The contract price for excavation was 14.7 cts., for foundation for pavement and for shoulder, 75.5 cts., for black base (average 3 in. thick, 304 lbs. per sq. yd.), $1.355; for sheet asphalt surface $1.49, for shoulder foundation (8 in. of waterbound macadam) 75.5 cts., for penetration macadam shoulders (3 in. deep) $1.35; all on the basis of the square yards of pavement and of shoulder respectively.

The two miles of road was constructed in 71 days, or 50 days less than the contract time, whereby the contractor earned a bonus of $500.

Paving Costs at Grand Forks

The city engineer of Grand Forks, N. D., J. J. Smith, sends us bids received May 14th for laying pavements of various kinds in that city. These included reinforced concrete and vibrolithic. The low bid on the former comprised the items $2.55 per square yard of reinforced concrete pavement 7 inches thick and $2.25 for pavement 6 inches thick; also 5c. per pound of castings, 45c. per lineal foot of straight curb and 50c. per lineal foot of circular curb, 35c. per cubic yard for earth excavation, and 5c. per pound for reinforcing bars. The concrete is made of screened gravel and the price for 7-inch pavement includes 40-pound wire mesh, while that for the 6-inch pavement includes 30-pound wire mesh. Wages run from $4 to $6 per day, team with teamster $6 per day; pit gravel costs $1.65 per cubic yard (3,000 pounds) f.o.b. Grand Forks, with a 1-mile haul. Cement costs $2.70 net.

Only one bid was received for the vibrolithic pavement, this being $2.85 for pavement 7 inches thick and $2.55 for pavement 6 inches thick, with wire mesh reinforcement as above.

These bids were received as alternatives for the same street and the total low bid for the reinforced concrete was $7,060 and for the vibrolithic $7,741.

At the same time bids were received by Mr. Smith for two lines of sewers. In each case the low bidder bid $70 apiece for brick manholes and $60 for catchbasins; $1.50 per lineal foot for 12-inch pipe sewer at an average depth of 11 feet and 75c. per lineal foot for 8-inch pipe sewer at the same depth. In each case all material and labor necessary for completing the sewer was included. In one contract there was also 215 feet of 6-inch sewer for which 60c. a foot was bid.

Toledo Garbage Disposal

The Street Department of Toledo, Ohio, collects garbage in city-owned trucks and horse-drawn wagons. Part is delivered to the Pan American Feed Milling Company, and the surplus which that company cannot take care of is hauled on to farms and plowed under; which hauling requires from six to eight hired teams. The collecting force comprises thirty wagons and teams, six one-ton Ford dump trucks and two Ford roadsters, with an average of sixty men as drivers and helpers and three foremen. This force last year collected 14,508 loads, estimated to weigh 31,214 tons.

The Department maintains a foreman and eleven men taking care of 100 horses and mules at the barns and stables, another man for repairing harness, and a horseshoer and assistant who do all the shoeing of horses and mules for both the Street Department and other city departments; also, in the blacksmith and wagon shop, one floor man, two blacksmith helpers and one wagon maker. There are also employed a carpenter, a painter and three men with a single rig and horse who repair pumps and watering troughs throughout the city.

Increased Efficiency of Power Plants

A remarkable increase in efficiency in the use of fuel at public utility power plants during the four years, 1919 to 1923, inclusive, is reported by the Department of the Interior. A recent bulletin of the Geological Survey states that, averaging the results shown by the monthly productions at about 4,000 power plants engaged in producing electricity for public use, a ton of coal produced 625 k.w.h. of electricity in 1919, while in 1923 the same amount produced 835 k.w.h., an increase in efficiency in the utilization of fuel of 33 1-3%. This gain in efficiency just about balances the increased cost of fuel so that current is produced at practically the same cost as before the war.

In spite of the increased attention paid to water power development, the electricity produced for public utility power plants in this country by the use of water power has decreased from 37.5% of the total in 1919 to 34.8% in 1923. The actual amount of water power used, however, has increased considerably, since the total of electricity generated has increased over 43% in those four years. In 1923 the amount of power obtained through the use of

water power would have required 23¼ million tons of coal, according to the calculations of the Geological Survey, which would have cost considerably more than $100,000,000. During this period New York State, which was the largest producer of electricity by water power in 1920, dropped to second place, California ranking first during the past three years.

Water Purification by Aeration

Conditions resulting from aeration and probable causes. Promotes chemical activity. Electrification of drops by spraying. Aids in coagulation and in iron removal.

Aeration has been used more or less in waterworks plants, especially during recent years, but in many cases the amount of benefit rendered, or in fact whether there is any, and the chemical or other actions involved in such benefit, are not often studied or perhaps given much consideration; there being merely a general idea that aeration secures oxidation of the water which is always beneficial, and releases any gases that the water may contain.

In a paper presented a few weeks ago before the Indiana Sanitary and Water Supply Association, Malcolm Pirnie, of the firm of Hazen & Whipple, considered at some length the conditions resulting from aeration and the probable causes of the results, and described a number of aerating appliances and the results secured by them.

"The most obvious effect of aeration is that of increasing enormously the surface of the water in contact with the air. Such an increase in surface promotes chemical activity. Soluble substances are concentrated to a high degree at the surface of water so that when this surface is increased reaction between them may take place in much more concentrated solution than could exist in the undisturbed body of water. When water is disintegrated into a fine spray in air surface concentration necessarily influences reactions between impurities contained in the water and between them and certain of the elements in the air. Whether this is advantageous or not in combination with other treatment of the water depends upon the kind and state of the impurities.

"Another effect of aeration which opens an interesting field for investigation is that of electrification. Electric rain and electric sand storms are large scale demonstrations of electrification of drops of water or particles of solids falling through air. Water in a waterfall becomes charged with positive electricity, while the air close to it becomes negatively charged. It has been demonstrated that the soluble impurities in water influence the magnitude and even the sign of the charge on the drops when it is broken into a spray and also that when the spray is formed by a nozzle discharging wet steam the material of which the nozzle is constructed influences the charge on the drops. Likewise the humidity of the air in contact with a water spray is a factor in the size of charge developed on the drops. Probably other factors also are responsible for variations in electrification, but we have mentioned enough to account at least in part for variable efficiency in aerators where changes occur in the condition of the air or in the impurities contained in the water.

"The charge upon drops of water in air has been ascribed to the specific absorption of positive ions from the air. If so, some of these may well be hydrogen-ions. The positively charged drop is said to have a lower vapor tension than a neutral drop and it is probable that it has a greater attraction for oxygen molecules in the surrounding air. As oxygen is readily soluble in water in greater concentration than carbon dioxide and may assume a charge of the same sign, it should assist in expelling what carbon dioxide there is in a free state in the water. Whatever the explanation of the action may be it is well known that fine spray aeration is successful in removing such gases as carbon dioxide and hydrogen sulphide if the water is sufficiently free from other impurities which have a force of attraction for these gases greater than the induced force tending to expel them."

Watertown, N. Y., derives its supply from the Black river, which contains a large amount of organic coloring matter contributed by natural conditions on the drainage area, and also waste liquors from sulphite pulp mills. The water is usually slightly acid, although methyl orange alkalinity of more than 30 is quite common. It is dosed with aluminum sulphate at the entrance to a basin with a capacity of five to eight days' flow, the effluent from which is pumped through a fountain aerator, the spray falling on a bed of broken limestone; then, after four hours in the coagulating basin, it passes to mechanical filters. Formerly, when there was no aeration between the application of the doze and the filters, it was impossible at times to clean the water, considerable impurity passing the filters and the water causing almost universal red water trouble and destroying service pipes. The CO_2 content was high, the color sometimes exceeded sixty parts per million, having averaged twenty-two parts in 1917 before aeration was begun. For the past two years monthly averages of color of the effluent close to zero had been common, while the average for the year 1922 was seven parts to the million. The CO_2 is around 2, and complaints of red water have practically ceased. Much less chlorine than formerly is required to sterilize the water and the sulphite

taste and odor, which used to be quite strong, are now faint when present at all.

West Palm Beach, Fla., uses water with a color about twice as high as the Black river water, or as high as 200 parts per million. It is dosed with aluminum sulphate and pumped through nozzles which break it into a fine spray which falls into an open 8-hour coagulation basin, from which it flows to mechanical filters. Colors of 200 are reduced below 20 without difficulty. From 500 to 1,000 pounds of aluminum sulphate per million gallons is required. The CO_2 is reduced from 30 before spraying, to 16 in the falling spray, 8 on top of the filters and 6 in the filter effluent. Another aeration would greatly improve the quality, the spray from a lawn sprinkler having shown a further reduction of the CO_2 to two parts per million.

Danville, Va., uses water from the Dan river that carries a considerable amount of red silt, a slight amount of organic coloring matter and about two parts per million of iron. Good coagulation with aluminum sulphate alone was not obtained in less than twelve to twenty hours in the basin. Experiments demonstrated, however, that a definite amount of soda for a given dose of alum just sufficient to maintain the raw water pH would cause immediate coagulation, with clear water between the particles of floc. However, after standing a few hours some turbidity reappeared, indicating instability, the change being coincident with a loss of CO_2 and an increase in pH above that of the raw water. Half the former soda dose was then tried with the same alum dose and immediately aerated, when a perfect floc formed at once, although it required eight to ten hours for the same mixture when unaerated. The Danville plant is now being built over and will be equipped to supply soda and aluminum sulphate to the suction of the raw-water pump, which will force the water through a fine spray aerator, from which the water will rise through a 10-minute whirling mixer and from this will pass around baffles in a 5-hour basin to the filters. It is expected that aeration will save about 50% of the soda that would otherwise be required.

A supply at Long Beach, L. I., is from wells over a thousand feet deep and contains about seven parts per million of iron, forty parts of CO_2 and ten parts of silica. The water is pumped through a fine spray aerator in a vented room, falls on the floor and collects in two troughs and thence flows to the bottom of and upward through a series of concrete boxes containing 9 feet depth of graded gravel. The removal of iron is practically complete, the hydroxide forming in the voids of the gravel, from which it is washed out every day or two. In this case aeration removes only 75% of the CO_2, but the water is colorless and further aeration does not reduce the CO_2 materially. The importance of the aeration has been demonstrated experimentally by subjecting the unaerated water to conditions otherwise identical, when only a small part of the iron was removed.

Aeration of the effluents from the mechanical filters at Poughkeepsie and Albany, N. Y., both treating Hudson river water, has proved efficient in removing CO_2 and raising the pH when the raw water is properly dosed with aluminum sulphate. Aeration is of little benefit, however, if the coagulent is not applied in sufficient quantity to produce a good floc. The plans for the new Albany plant call for spray aeration of the scrubber effluent in addition to spray aeration of the dosed raw water before it enters the coagulation basins.

These and other cases show that aeration is very useful in water purification but that "the results obtained vary according to the kinds and amounts of impurities in the water. We are not yet in possession of sufficient knowledge to allow us to determine by chemical analyses the exact combination of treatments best suited to the purification of a given source of supply. Experiments are valuable in indicating what treatments are of value and in what order." However, "theories must be used as a guide" to these experiments "until the exact science of water purification has advanced beyond the present stage."

Filtration in Philadelphia

In his report for the year 1923, Fred C. Dunlap, chief of the Bureau of Water of Philadelphia, compares the mechanical or rapid and the slow sand filters as follows:

The operating costs of the filters were as follows:

	Total Cost	Cost per Million Gallons
Belmont	$ 86,499.97	$5.05
Queen Lane	151,039.06	5.68
Upper Roxborough	18,299.23	6.12
Lower Roxborough	30,032.91	4.86
Torresdale	200,428.76	3.08
Total	$486,299.93	$4.12

About 40 million gallons per day of the output from the Queen Lane plant was filtered through the mechanical units recently built. The remainder at this and other plants was filtered through slow sand units.

Considerable study has been given to the cleaning of the slow sand beds with machinery. Three Nichols scraping machines have been employed with success both in time and expense.

One Blaisdell machine for cleaning, without the removal of the water, was tried for about a month at Belmont with good results.

It is believed to be possible to greatly increase the output from the slow sand units of the Queen Lane filters by the installation of machines of sufficient size to clean one section of each bed during one trip of the machine.

The cost of the chemicals required for a mechanical plant are more per million gallons than the entire cost of filtering by the slow sand method. It is worth while therefore to make an expenditure for filter cleaning machines, particularly if by their use the quantity filtered per acre can be increased.

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Association of Sewage Works Managers

In our May issue we gave brief announcement of the decision of the New Jersey Sewage Works Association to change its name to the American Sewage Works Association with a view to making it a national organization. Several of the state health boards have been instrumental in the creation of more or less formal organizations of those in charge of sewage treatment plants in the respective states; but in view of the several thousand plants in this country, the organization of sewage plant superintendents and their cooperation for mutual benefit has hardly made a start.

For a number of years there has been in England an Association of Managers of Sewage Disposal Works which seems to be quite flourishing. The attendance at its annual conference on July 5 was 104, which would appear to be excellent for a total membership at that time of 289. These conferences are conducted along much the same lines as those of waterworks superintendents in this country, there being reading and discussion of papers and visits to sewage treatment works at and near the place of the conference.

The greatest need in this country in connection with sewage treatment is a more intelligent and painstaking operation of plants that are constructed. Aside from the improvements that this will secure in the operation of plants, the greater care in operation and the comparison of results that are bound to result from the organization and periodical meeting of sewage works superintendents will furnish information valuable to the designers of plants and thus hasten elimination of unsatisfactory features and development along more effective practical lines.

Minimizing Seasonal Construction

The U. S. Department of Commerce, Secretary Hoover, and others who are interested in the conservation of resources and in securing maximum effectiveness of labor and capital of the United States, are continuously engaged in an effort to secure the spreading over a larger part of the year of such construction work as is now confined to more or less than half of it.

At the present time there are many industries, the most important of which are probably coal mining and building construction, the activities of which are reduced by fully a half or three-quarters during a number of months of the year. Since those employed in these industries must live during the time of idleness, their wages when at work must be sufficient to carry them over these periods and therefore must be greater per unit of work done than would be necessary if this work were spread over the entire twelve months. There would seem to be no question but that it would be to the advantage of all concerned, both producer and consumer, could work of all kinds for all engaged therein be spread uniformly throughout the entire year. While this probably cannot be completely effected, there is no question that much can be done toward approximating it.

In a recent publication of the Department of Commerce entitled, "Seasonal Operation in the Construction Industries," the part that public works and public officials can and should play in bringing about this result is stated as follows:

> Public works form about 25 per cent of all construction activities, varying in the last few years from three-quarters of a billion to over a billion dollars. They are, therefore, of great potential importance in stabilizing general construction activity. Out of 200 engineers in all parts of the country who replied to the committee's question, "Are public improvements rushed right along in the peaks of the annual building season?" 192 answered in the affirmative. The

comment was frankly added that public works are undertaken without regard to private needs.

The need for public works can usually be foreseen well in advance. Legislators, administrative officials, and the public should unite to see:

1. That contracts for public works are let when the work can be performed economically and with the least possible interference with private construction.
2. That the Government, whether National, State, or local, has its construction program planned ahead for several years subject to such revision as new conditions may require. This permits thorough consideration of all factors affecting the work, and helps to avoid the waste which invariably occurs when plans and financing arrangements have to be rushed through at the last moment.
3. That public officials are given funds with which to plan work when definite authorization at a future date is virtually certain.
4. That administrative officials are given latitude as to the time for awarding contracts and setting dates for their completion, so that such work can be undertaken when employment and other conditions are most favorable.

It is suggested that if every contractor should keep a proper cost account and "put his equipment on the payroll," many of them would be surprised to find how great is the cost of this seasonal idleness or, in other words, how much the overhead part of their unit costs would be reduced if their equipment could be operated during a larger part of the year.

Among the kinds of work which could be carried on to advantage in winter are suggested excavating and filling on large jobs involved in public works or public utility operations; also street and lot grading in sub-developments where steam shovels and motor truck fleets may be employed.

Gasoline Taxes

At the beginning of this year thirty-six states had authorized the collection of a tax on gasoline and other liquid fuels to be used mainly in the construction and maintenance of highways. In connection with the consideration of this subject by the State Legislature of New York, the Special Joint Committee on Tax and Retrenchment a few weeks ago reported the result of an investigation which it had made.

This investigation showed that most of the states adopting this form of tax before 1923 fixed the rate at 1c a gallon. During the 1923 legislative sessions, twelve of these states amended the laws to increase the rate, six of them to 3c a gallon and the other six to 2c. Three-quarters of the states collect a tax from the importer or manufacturer and the others from the wholesaler or retailer. The former method is considered much the more satisfactory because it is easier to check up the reports and involves a smaller number of accounts.

While the purpose of the gasoline tax is generally stated as obtaining funds for public highways, North Dakota and Georgia place the entire amount collected in the general fund to be appropriated as the legislature may see fit; Pennsylvania and Alabama credit one-half of the tax to the general fund and distribute the remainder to the various counties for road purposes. Montana gives the general fund four-tenths of the total tax, the state highways two-tenths and the county highways four-tenths. New Mexico gives all to state highways except $15,000 for the state fish hatchery. South Carolina distributes equal amounts to the general fund, the maintenance of state highways, and to county roads. Texas assigns one-fourth to the public school fund because of constitutional requirements and the balance to the state highways. The other twenty-eight states devote the entire gasoline taxes to highway purposes.

A number of the states exempt from the tax all fuels for motors not employed on the highways, such as that used for propelling boats, running stationary engines, etc. Two-thirds of the states, however, have allowed no exemptions, apparently regarding the ease of administration and collection of the tax as outweighing the few injustices that may result from its universal application.

The constitutionality of the tax has been upheld in a number of recent decisions. An exception is that of the tax law of Louisiana which has been declared unconstitutional because the act refers to it as a license tax, whereas the method of carrying out the law makes it a sales tax in the opinion of the court.

Based on the facts and figures collected, the Committee estimated that the gasoline tax in the thirty-six states would yield $51,691,000 in 1924, but since this was based upon 1923 registration of motor vehicles, they considered it probable that the actual revenue might exceed this by four or five million dollars.

City Gasoline Tax

Garden City, Kans., has been levying a tax on all gasoline sold within the city since September last, and Mayor H. O. Trinkle reports that objections to it are no longer heard. The city levies a tax of 1c. a gallon, which is collected monthly on the sales of the previous month.

The sales of gasoline within the city for June of this year exceeded those for the month of June last year, when there was no gasoline tax, so that apparently the tax is having no serious effect upon sales within the city. Up to the present there has been no friction between the city and any of the various oil companies that have filling stations there. During the first nine months the amount of tax collected was $2,800.

The ordinance requires that the tax be paid by "every person, firm or corporation shipping or hauling gasoline into the city of Garden City, Kansas, for the purpose of sale at wholesale or retail within said city," and specifies that the money received from this license shall be used "only for the purpose of bringing to grade and improving the unpaved streets of said city."

Sewer Rates in Fitchburg

The city of Fitchburg, Mass., in 1922 established a new and uniform rate of assessment for sewers in all sections of the city. The rate established by the new order is 1c. a square foot on land within 100 feet of the street line, plus 20c. a front foot. This is estimated to return to the city about 75% of the average cost of the sewers exclusive of manholes and catchbasins, the remainder being paid by general taxes.

Maintenance of New York State Highways

$12,500,000 spent for maintenance in 1923. Organization in nine divisions. Spring repair work. Surface treatment, patching and repairs.

Prior to 1909 the highways of New York State received practically no attention in the way of maintenance and their rapid deterioration was one of the contributing factors toward the formation of the State Highway Commission in that year. A maintenance department was at once created and an appropriation of $1,500,000 for maintenance was obtained. This has been gradually increased until in 1923 about $12,500,000 was spent. The maintenance department has developed in both organization and operations, and its methods and results for 1923 were described before the highway conference at Cornell University by A. W. Brandt, second deputy of the Bureau of Highways of New York State. From his complete and very interesting paper the following outstanding points are abstracted.

There are nine divisions, each in charge of a division engineer, and each county is under charge of a county assistant engineer, a few of the counties having two assistants. Each of these has supervision over all general maintenance for a mileage varying from 80 to 250 miles in the different counties. Each county is divided into sections, each of which contains 10 to 30 miles of road, depending on type and general conditions.

A foreman with a 1-ton truck is in charge of maintenance of each section, aided by a skeleton gang consisting of two to six men, which can be increased to any desired number when necessary. In addition, there are 3-ton truck gangs in charge of a foreman with six to fifteen men, which are placed on sections known from experience to be bad and apt to cause trouble each Spring. These truck gangs are better equipped than the smaller ones for small resurfacing and reconstruction jobs. They may even be enlarged into reconstruction gangs for emergency projects.

Finally there are the heavy maintenance gangs, which are similar in character and makeup to the truck gangs just described and usually have their headquarters in large communities where labor is available and from which a considerable mileage of the weaker type of roads radiate. They are used to supplement the other gangs, especially in reconstruction and resurfacing. In addition to the gangs, there are a few free trucks with only a driver, which are used by section foremen for transporting materials and helping out on reconstruction work.

As soon as the general Spring thaw begins, each patrolman with one or two helpers begins opening up ditches and culverts so as to drain the roads as rapidly as possible and prevent the formation of soft spots and frost boils. Where frost boils or large breaks occur, nothing can be done until the ground is drained out except to fill the holes temporarily with cinders, gravel or stone.

Where it is probable that a road will be reconstructed during the coming season, only light repairs are made to breaks of this kind. These consist of removing the broken section to the original subgrade and replacing it with a patch of the same thickness as the original road—usually a bottom course of No. 3 stone and a top course of either penetration macadam or cold patch. The bottom course is rolled if the break is large enough to permit a roller to operate on it. If a cold patch top is used, No. 2 stone is first mixed with either asphaltic emulsion or asphaltic cutback and brought to within ½-inch of the desired surface, the same bituminous material mixed with No. 1 stone being applied for the wearing surface. This is tamped or rolled when possible. When there are many breaks, it is impracticable to roll all of them, but the State is now using small 3-ton and 4-ton rollers and finds them very satisfactory for this work.

If the break probably will not be repaired for several years, the broken section is entirely removed and the subgrade also to a depth sufficient to permit a 6-inch or 9-inch foundation course of field stone, followed by two 3-inch courses similar to those for light repairs.

Where a break is several hundred feet long, it is rebuilt with concrete when it is intended ultimately to repave the entire road with this material. In other cases, the repairs are made with bituminous macadam, penetration method. In these large breaks, plows, tractors, scrapers, trucks, etc., are used, and the bulk of the old road is removed by means of machinery, which is far more economical than hand labor. Here also a large 10-ton roller is used.

A method which has given excellent results, and which is more economical, is the placing of a 9-inch run-of-bank gravel course entirely over the broken section, gravel being used that is of a quality that can be rolled compactly. On top of this is placed a wearing course of 3-inch penetration macadam. This construction is practicable where the road passes through open country and the grade can be raised several inches without damage to adjacent property or any other objectionable features. Considerable of this work was done on the Albany-Binghampton main road a year ago, and Mr. Brandt was thoroughly convinced that it is practically as effective and much cheaper than taking out the old road and placing a new foundation course.

1923 was the worst year the State has experienced, so far as broken pavements are concerned. It was estimated that at least 400,000 yards of pavement broke up under traffic last spring and was restored during the summer.

TYPES OF PATCHING MATERIAL

New York State uses four different kinds of patching materials—asphaltic cut-back, which is a mechanical mixture of asphalt and gasoline or naphtha; tar cut-back, which is the same except that tar is used instead of asphalt; asphaltic emulsion, which is an asphalt suspended in water by means of a saponifying agent; and asphaltic binder. In the earliest spring repairs one of the cut-backs or binder is used exclusively, because they can be stocked along the roadside during the winter without freezing.

During the balance of the year different practices

are followed by the different divisions. One of the divisions uses binder almost exclusively with excellent results. It is not so convenient as the cut-back, because it must be heated, and with equally skilful men probably as smooth a patch cannot be made as with cut-backs and emulsions, but it is more permanent and requires less maintenance.

The cut-backs have been found as a rule the least satisfactory. Containing the same percentage of asphalt as the emulsion, they are much thinner and a thinner coating of asphalt is left on the stone after the evaporation of the naphtha. A cut-back patch made in summer may require oiling before work is closed down for the season in order to waterproof it and prevent disintegration during the winter, but this does not seem to be the case with emulsion. For this reason, the cut-back, although it may be appreciably cheaper, is considered by Mr. Brandt less economical than emulsion.

A decided disadvantage of the cut-back is that it dries very slowly and a crust forms over the top, retarding evaporation from the interior and leaving it soft. If the patch is deep and not sufficiently compacted, a heavy load may break through this crust and shove the material out of the break, this having occurred frequently. Where cut-back is being used in large quantities, the general practice is to mix it with the stone in a small mechanical mixer and dump it in storage piles, from which it is taken and applied to the patches several hours or even a day later. Unless the material is spread out in a thin layer, however, the interior of the pile will still be soft when it is used. In the case of emulsions, as soon as the mixture with the stone is made, the water separates, depositing the asphalt, which hardens within a few hours.

For surface treatment, the department uses what it calls "T.C.A.," or tar cold application, almost entirely. Mr. Brandt says: "While this may not be the best material, it is certainly the most fool-proof. Our experience with asphaltic oils a few years ago was unfortunate and disastrous. Our specification for what is known as light hot oil and which contains about 65% of asphalt, allowed at that time, out of 35% of the solvent oils, a minimum of 18% of volatile, leaving a maximum of 17% of non-volatile slow-drying oils." The asphalt companies persuaded the department to lower the minimum to 10%, with the result that the non-volatile oils fluxed the bitumen in the pavement and caused it to soften and shove under traffic. The specifications have now been changed so that a minimum of 25% of volatile is required, and Mr. Brandt believed that this would give much more satisfactory results. It has the disadvantage of not being so adhesive to stone as tar, but this affects its use on bituminous roads very little, as the asphaltic oils will adhere closely to the tar already present.

The department last year used for surface treatment asphaltic cut-back of the same specification as for patching. This is heavier than the other oils, and in cool weather did not flow readily from the nozzles. The specification for this year has been altered so that a larger quantity of gasoline will be used in the mixture, making it more fluid and adaptable to the surface treatment work. "The results of the use of asphaltic cut-back seem to have been exceptionally good. Material applied in the morning of one day is entirely dry the next morning, and I am sure that if it were to be universally used, we would receive the heartfelt thanks of all motorists." The principal disadvantage in using asphaltic binder and light, hot oil is the necessity for heating it in order to get it out of the tank cars, but it is believed to be well worth while to buy small portable boilers for use in those localities where steam cannot be obtained from factories.

Repairing concrete pavements with bituminous patches, which is quite common practice, is considered by Mr. Brandt to be at least only a makeshift and undesirable. The State expects this year to use for concrete repairs several small air compressors, together with non-rotating jackhammers and the necessary small drills and tools. In the case of broken corners or other broken sections, a rectangular or regular hole will be cut out, battering the sides so that it will be larger at the bottom than at the surface, and the subgrade will be excavated a few inches below the concrete. This will be filled with first-class concrete, struck off even with the old surface.

An Unusual Highway Embankment

Thick crust of salt necessitates use of special methods.

What is known as the Wendover Road, extending from the western edge of the Great Salt Lake desert, in Utah, to Wendover and the Nevada State line, is now under construction and when completed will close the last gap in another coast-to-coast highway. The route closely parallels what is perhaps the longest railroad tangent in the country, a 40-mile tangent of the Western Pacific Railroad, the highway being only a little over a hundred feet from the railroad.

This 40-mile stretch of desert road passes over a vast flat of salt-encrusted clay which becomes hard and white in summer but after storms is covered with several inches or even a foot or two of water. In some places the salt has a depth of three or four feet. The estimated cost of the road is about $400,000, which is slightly reduced by the special rates granted by the Union Pacific Railroad for hauling gravel from its pit at Dyke.

The contract for the final stretch of road was awarded to N. E. Lamas on the salt section. Owing to the effect of salt on men and horses, machinery only, consisting of trenchers and draglines and the necessary conveyors, is being used for throwing up the fill, which averages two feet the entire length of the road. No iron or concrete culverts can be placed in the embankments and no nails or spikes used, and consequently wood box culverts of treated lumber

fastened with hard-wood pins are employed throughout the project. There are also six pile timber bridges, each of 12-foot span.

The roadway is 24 feet wide across the top of the embankment and 42 feet wide on the bottom, with a slope of 3:1 on the south side of the road and 6:1 on the north. The railroad embankment provides sufficient protection from wave action on the south side, but on the north side wind and waves will have an unimpeded sweep of many miles. The northern slope is covered with gravel as a protection against wave action.

Construction of the embankment on the salt section was effected entirely with the use of a trencher and conveyor, which was kept running 24 hours a day, with only a small force of men to operate it. A series of trenches parallel to the road were excavated outside the limits of the roadway, the salt top being either wasted or used for filling some of the trenches already dug, while the underlying clay was elevated and conveyed to the roadway. This operation was continued even while the salt surface was covered with a foot or more of water. Gravel for surfacing was delivered by the railroad in con'inuous windrows between the track and the road and conveyed from there to the roadway. The gravel surfacing is 18 feet wide, 8 inches deep at the center tapering to 2½ inches at the edges.

Highway Research

Brief outline of report of Advisory Board on Highway Research of the National Research Council. Structural design; road materials; finance; maintenance

The National Research Council has published the proceedings of the third annual meeting of the Advisory Board on Highway Research, Division of Engineering, National Research Council, in a volume of 162 pages. The greater part of this matter is of much practical interest to highway engineers, and the reports of the several committes should be read by them carefully.

The most extensive reports were those made by the committees on economic theory of highway improvement, on structural design of roads, on character and use of road materials, on highway finance and on maintenance.

A few of the points brought out that impressed us as being most interesting are touched on below.

Investigations have been made and are being continued on wind resistance to motor vehicles. One set of experiments was made in which an automobile was floated on a raft in a large tank to eliminate friction and the pull due to the wind measured, the velocity of the wind being measured at the same time. Irregularities in wind intensity made accurate deductions difficult and a wind tunnel has been built, the automobile being suspended on a platform in an enlarged section of the tunnel and a record kept of the pull necessary to hold the platform at its normal position while air currents of constant velocity are forced through by a powerful fan.

The effect of the type of road surface on the wear of the automobile tires is being investigated by another committee. Up to date most of the work done has been in developing methods and apparatus for obtaining the desired records. Reference is made to work done at the University of Kansas in 1922 in which was determined the loss of weight of tire per hundred miles traveled over asphalt, brick and concrete. Calling the rear wheel wear on concrete 100, the same wheel lost on brick 53.3% as much and on asphalt 27.2%; while the front wheels lost 80.6 on concrete, 34.5 on brick and 15.3 on asphalt.

Investigation is also being made of the cost of operating motor vehicles; rolling resistance and related characteristics of roadway surfaces; and research on rubber tires. The last is being studied by the U. S. Bureau of Standards, in connection with other federal departments and tire manufacturers with a view to establishing a standard specification for purchasers and a method of making tests of tires that will give the desired information.

The Committee on Structural Design of Roads dealt with the subject under the two heads of "Results of Research on Highway Design," and "Problems for Further Research." Under the first heading reference was made to tests carried on by the North Carolina State Highway Commission, the Illinois Department of Public Works, Iowa State College, The American Society of Civil Engineers, the Ohio State University and the U. S. Bureau of Public Roads. An interesting discussion is given by Dr. Strahan of Georgia on "Principles and Methods for Sand Clay, Topsoil and Semi-Gravel Roads." He investigated a large number of roads of varying success and the materials of which they were constructed, and classifies these as Class A-hard, Class B-medium and Class C-soft. In the Class A roads the proportionate amount of clay varied between nine and eighteen per cent as against ten to twenty-five per cent in the "C" roads; the silt varied from 0 to 15% as compared to 10 to 20% in the "C" roads; the total sand varied from 65 to 80% as compared to 55 to 80% in the Class "C" roads. Perhaps the most important comparison is that of the size of the sand; that in the Class A road showing 45 to 60% above No. 60 sieve size, while in the Class C roads only 20 to 30% exceeded that size. "Coarse material above No. 10 sieve has a decided influence on the durability, hardness and smoothness of the surface. Ten per cent of such hard, gravelly material with a Class B soil mortar justifies reporting the whole as a Class A material." In the case of Class C roads, long heavy rains soften the surface so that wheel ruts two or more inches deep may appear under heavy vehicles and fine sand is washed down the steeper grades and into the side ditches. Class A roads do not materially soften except where the water stands for a long time in depressions, and wheel ruts rarely exceed 1-inch in depth.

Relative to the problems offered for further research, the Committee names twenty-nine. Among 'hese are: Study of elastic properties of subgrade soils; the effect of longitudinal reinforcing on trans-

verse temperature cracks in a Portland cement concrete slab; the effect of an asphaltic top course on a Portland cement concrete base in changing the magnitude or rate of vertical motion due to temperature changes; need of dowels in the 2-section pavement; the increment of strength added to pavements by thickened edges; further study of beneficial effect of admixtures on plastic subgrade and the depth required.

The Committee on the Character and Use of Road Materials had considered twelve problems dealing with tests of concrete, grading of aggregate, the Jones-Talbott rattler, effect of grading mineral aggregates on sheet asphalt, etc. Discussing the methods suggested for grading aggregate such as the fineness modulus and surface area methods, the statement is made: "It can be shown that with materials from a given source these various functions have definite relations with each other, but that with random materials from different sources no such definite relation obtains. It is probable that equivalent concrete mixtures can be designed by each method for aggregates generally similar, but varying in grading."

Concerning most of the other problems very little is reported except to state the present condition of the research. Concerning the effect of grading of mineral aggregates on sheet asphalt and bituminous concrete construction, relative to deformation of surface under traffic, it is said: "It is surprising that so little conclusive research has been carried on in this field. All investigators emphasize the need of more information. The committee considers this a very important field for research."

The Committee on Highway Traffic Analysis summarizes information obtained from traffic surveys made in Connecticut, Maryland and several other states.

Concerning crack fillers for concrete pavements, it is reported that a satisfactory light colored filler at a reasonable price has not been developed, and it is believed that the demand for it has largely disappeared since the public has become accustomed to the black streaks of tar filler in concrete roads. Reference is made to an extensive test of crack fillers, including three tars, nine asphalts and blown oils, one emulsified asphalt and one light colored filler, being carried on by the Iowa Highway Commission.

The above merely touches the high points of the reports presented at this meeting, and those interested are urged to consult the full proceedings as published in the March Bulletin of the National Research Council.

City Replanning

Proposal for relieving street congestion by parking inside building lines and placing sidewalks level with second floor.

This subject was discussed by Harvey W. Corbett, a New York architect, in an address before the Engineers Club of Philadelphia and the Philadelphia Section of the American Society of Civil Engineers, in which he proposed plans for relieving traffic congestion by changes in buildings and in street cross-section rather than in street lay-out.

FIG. 1. PRESENT CONDITION: ONE LINE OF MOVING TRAFFIC.

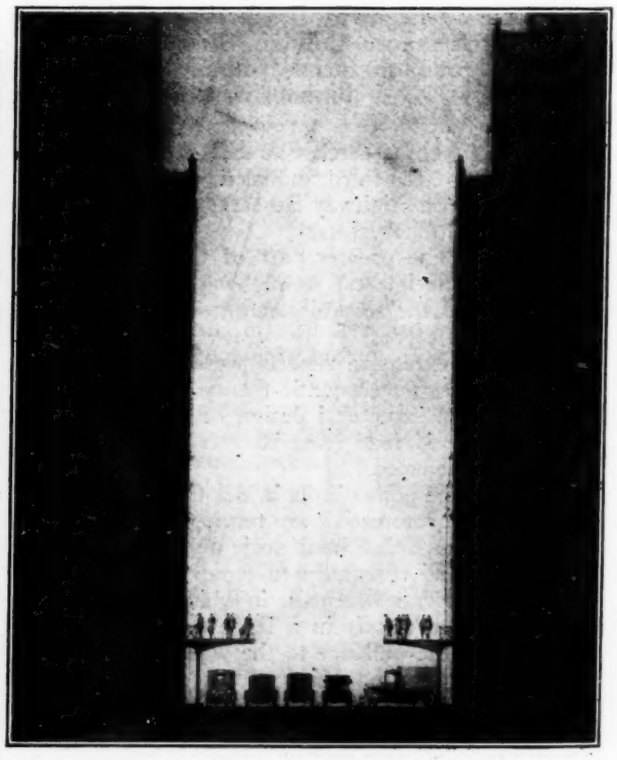


FIG 2. FIRST STEP—ELEVATED SIDEWALKS.

FIG. 5. DEVELOPMENT COMPLETE, WITH UNDERPASS AT STREET CORNERS.

He gave it as his opinion that in New York the chief congestion was in the 60-foot cross streets, and that the vans and trucks chiefly responsible for it were vitally necessary to the commerce of the city; that provision must be made for their standing while loading and unloading.

In relieving congestion, his remedy would be to divide the traffic into three classes, rail, wheel and foot, and separate these classes. Since the area devoted to streets can not be greatly increased (there is already one acre of streets for each two acres of buildings in the 42nd Street district), the separation must be vertical rather than horizontal, the rail being placed underground, the wheel on the surface, and the foot (being the lightest) in the air. The elevated sidewalk would be carried on cantilevers supported on posts a few feet from the building line, as in Fig. 2, and at the level of the second floor of the building, where there would be entrances. This would allow side parking on the ground level and three lines of moving traffic instead of one. When more room is needed, parking outside the building line would be prohibited, and owners of buildings would be required to provide parking space inside the building line, as in Fig. 3. (This would be impossible while the sidewalk is at street level, said Mr. Corbett; but there are probably several score of instances of such construction already to be found in the city.)

The next step would be to place the sidewalks also inside the building line, so as to give more light and air in the street, and carry them across intersecting streets at the same level, as in Fig. 4. This having been done, grade crossings of roadways can be eliminated by undercuts, as in Fig. 5. Then six lines of traffic could continue without stop where one line now winds a tortuous way between parked cars and is stopped by cross traffic every few streets.

Mr. Corbett does not believe human beings can be made to deconcentrate, but that in the

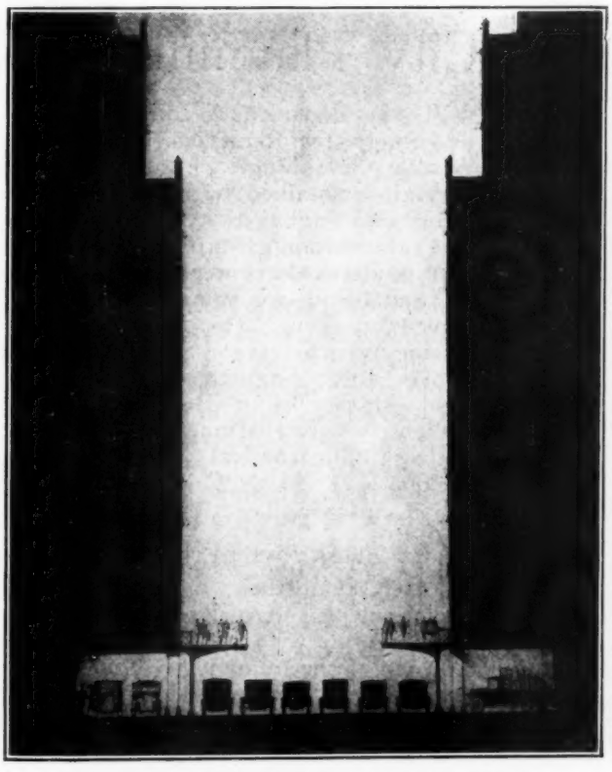


FIG. 3. SECOND STEP: PARKING INSIDE BUILDING LINE.

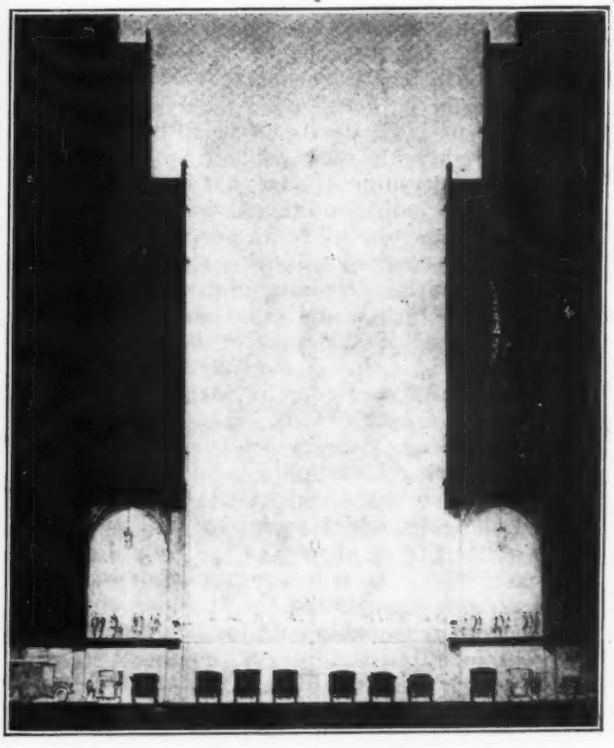


FIG. 4. THIRD STEP: INTERIOR SIDEWALKS AND STREETS BRIDGED.

ideal business district of the future as many will and should occupy a square foot of land as is consistent with good sanitary conditions; and traffic arrangements must be made accordingly.

Surfacing With Rock Asphalt

An experiment in the use of a thin covering of rock asphalt on waterbound macadam roads has been conducted on a road in Franklin county, Kentucky, by the Maintenance Division of the State Highway Department. John S. Dawson, engineer of maintenance, describes the treatment as follows:

"Prior to the placing of the rock asphalt the road was thoroughly cleaned and the voids well opened by brooming; then an application of light tar at the rate of one-fourth gallon per square yard was made. The tar was allowed to penetrate thoroughly into the macadam, and the road to become thoroughly dry before the next step. The rock asphalt was then spread from piles dumped at convenient intervals along the center of the road and carefully raked to a thickness of one inch loose. It was then rolled with a ten-ton roller (a five-ton tandem roller is recommended) until the asphalt was compacted, care being exercised not to roll the material excessively. It was found by experience that three times over with the roller was sufficient.

"Some difficulty was experienced in keeping a strip of rock asphalt from breaking off at the edges under rolling or traffic and being lost by disintegration. This was overcome to a large extent by painting a strip of the macadam about twelve inches wide along each edge with an asphaltic cement cut back with gasoline, which acted as an additional binder between the stone and asphalt. After rolling the rock asphalt, each edge was feathered by means of a cold hand tamp.

"A total of 1,480 square yards of road surface was covered with rock asphalt spread at the rate of twenty-nine square yards to the ton. The cost, including material, hauling, spreading and rolling, was 47 cents per square yard of road surface covered. To this should be added the cost of surface cleaning and placing the tar prime coat, which was 4 cents per square yard, making a total of 51 cents per square yard for the completed work. A compacted thickness of approximately three-fourths inch of rock asphalt was obtained.

"The work was done in October, 1923, and has, since completion, been subjected to a heavy traffic. It is reported (April, 1924) to be making a good showing, which seems to justify an estimate of its life at eight years. Should this be the case, the cost will average approximately 6½ cents per square yard per year, which I consider a very reasonable cost for the type of surface obtained.

"Although this is a little lower than the cost for surface treatment, which for the calendar year 1923 averaged 6.8 cents, yet it is too soon to draw any very definite conclusions. Rock asphalt used in this manner has the decided advantage over surface treatment of interrupting traffic once in probably eight years as compared with four to eight times in the same period for surface treatment.

"The outcome of the experiment will be awaited with considerable interest on the part of the public as well as the Road Department. Although this attempt may not prove satisfactory, it will certainly throw considerable light on the situation and be of material help as a guide to further experimentation."

Diagonal Joints in Concrete Roads

A road of reinforced concrete known as the Kingston By-pass Road is being built in England with the unusual feature of diagonal joints. It is laid in slabs the full width of the road and 14 ft. long, the joints being placed at an angle of 60 degrees with the curb. This, says W. P. Robinson, county surveyor, is "to obviate two wheel-loads of any vehicle striking the joint at the same time, thus reducing the stress along the edge of the bay, and to reduce the resistance to expansion of the concrete, thus assisting in eliminating the tendency to bulging and cracking of the concrete due to expansion. The reinforcement was carried through the joints to ensure equal settlement for contiguous bays."

"The filling to form the embankments was being consolidated by caterpillar tractors, which were very effective for this purpose."

Traffic Problems and City Planning

In the June issue, under the headings "Traffic Problems and Suggested Remedies," "Width of Streets" and "City Planning" we gave a summary of information obtained, by means of questionnaires, from city engineers. Since the compilation of the information given therein and the tables in that issue we have received eighteen more replies, and below we summarize the information given by them. The cities included in this supplementary list are: Santa Barbara, Calif.; La Porte, Ind.; Augusta, Me.; Webster and Westfield, Mass.; Flint, Hamtramck and Muskegon, Mich.; Virginia, Minn.; Biloxi, Miss.; Springfield, Mo.; Chillicothe and Cuyahoga Falls, O.; Woonsocket, R. I; Sioux Falls, S. D.; Galveston and San Antonio, Tex.; and Sheboygan, Wis.

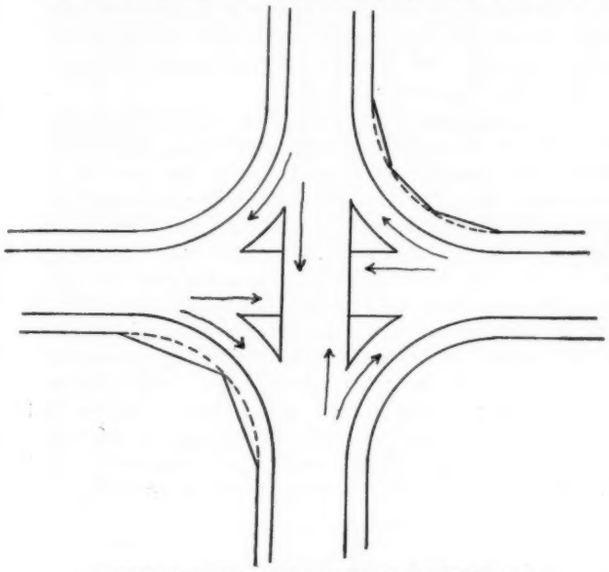
STREET PROBLEMS DUE TO TRAFFIC

Seven reported that their most important problem was narrowness of roadway; five, parking; two, intersections with poor visibility; and one reported each of the following: Poor street plan, street car tracks, pavement destruction by trucks, and lack of a sufficient number of improved streets, thereby causing concentration on a few.

REMEDIES SUGGESTED

The remedies suggested included widening streets (by 4 city engineers); widening roadways (by 3); more streets parallel to the main thoroughfare (3); rounding corners for visibility (3) (one, so as to give view for 150 feet up to the intersecting street); parking places (1); one-way streets (1); and eliminating autos and left-hand turns from congested district (1).

To accommodate increasing traffic, H. C. McClure, city engineer of Flint, Mich., recommends separation of grades at the intersections of crossings of heavy-traffic highways, with sufficient widening of streets near the corners to permit of the grade separation.



SEPARATION OF ROADWAY GRADES AT INTERSECTION.

Archie E. Ranny, city engineer of Coyahoga Falls, O., suggests that merchants, instead of blaming the city engineer for not providing, for parking purposes, ground space (which is limited), utilize some of their own space (which extends from the center of the earth to the stars) for this purpose for their customers; predicting increased business for those who do this.

WIDTH OF STREETS

The width of business streets in the various cities ranges from 33 feet to 100 feet, and main thoroughfares, 36 feet to 100 feet. Nine report the average width of business streets less than of main thoroughfares; 5 that it is greater, and 3 that it is the same.

Residence street widths range from 26 feet to 120; most, however, lying between 40 and 80 feet.

Seven cities had widened some of their streets because of increasing traffic at costs varying from $9,000 to $2,000,000. Three have widening now under construction at costs estimated at $80,000 to $500,000; while five propose widening one or more streets at costs of $15,000 to $500,000.

CITY PLANNING

Thirteen of the cities have planning commissions or bodies with city planning functions, but 6 have as yet had no comprehensive city plan prepared, 4 have plans now under way, one had a plan prepared in 1923 and one in 1920.

In only four cities have any parts of the plans been carried out; in one, parks; another, zoning; a third, street widening, and the fourth, street widening and sewers. None have made any official plan for future street layout.

In five, traffic counts have been used in street planning (in one, made by the Police Department), and in 7 special studies have been made of traffic conditions.

Miscellaneous City Paving

The amounts of sheet asphalt, bituminous concrete, bituminous macadam, rock asphalt, brick, stone block, concrete, macadam and gravel pavements laid in 1923 by nearly five hundred cities have been given in tabular form in recent issues of PUBLIC WORKS. A number of the cities laid other kinds of pavement, and the amount and cost of each are given in the paragraphs below:

Asphalt block was laid at St. Petersburg, Fla., 45,000 sq. yds., costing $140,000; Orange, N. J., 3,055 sq. yds., costing $12,942; South Orange, N. J., 28,000 sq. yds.; Batavia, N. Y., 0.17 mile, costing $17,366 (including grading, curb and other improvements); Rochester, N. Y., 5,051 sq. yds., costing $19,800 (surface and base); Urbana, O., 21,000 sq. yds., costing $98,000 (including base, grading, curb and sewers).

Vibrolithic was laid at Muscatine, Ia., 4,106 sq. yds., costing $10,265; Yankton, S. D., 106,595 sq. yds., costing $256,000; Aberdeen, S. D., 114,000 sq. yds., costing $279,500.

Creosoted wood block at Minneapolis, Minn., 70,133 sq. yds., costing $355,552 (surface, base and grading); New York City, 0.2 mile, costing $24,219; Dayton, O., 9,325 sq. yds., costing $4.50 per sq. yd.; Knoxville, Tenn., 3,188 sq. yds., costing $5,442 (including base, grading, curb and sewers); Seattle, Wash.; Beloit, Wis., 11,360 sq. yds.; Madison, Wis., 22,698 sq. yds., costing $4.50 per sq. yd.

Willite at Rochester, N. Y., 25,584 sq. yds., costing $77,250 (including base); Oklahoma City, Okla., 12,671 sq. yds., costing $50,954 (entire improvement); Connellsville, Pa., 3,466 sq. yds.; Greensburg, Pa., 30,879 sq. yds., costing $60,213; Scottdale, Pa., 2,588 sq. yds., costing $4,918; Knoxville, Tenn., 1,166 sq. yds., costing $6,500.

Amiesite at Allentown, Pa., 1,128 sq. yds., costing $3.35 per sq. yd.; Hazleton, Pa., 2,505 sq. yds.

National at Burlington, Vt., 17.9 miles.

Cinders at Conneaut, O., 36 miles; Burlington, Vt., 5,556 sq. yds., costing about $1,000; Kaukauna, Wis., 3,000 sq. yds., costing $749 including grading.

Shell at Houston, Tex., 110,881 sq. yds., costing $88,402 (entire improvement).

Plank at Aberdeen, Wash., 0.16 mile, costing $4,000.

Other kinds of pavement built in previous years but not during 1923 include Hassam (at Selma, Ala., Kansas City and Wichita, Kans.,

Niagara Falls, N. Y.); bitoslag (Meriden, Conn.); sand-clay (Pensacola, Fla.); dolarway (Pocatello, Ida., Walla Walla, Wash.); bitulithic (Pocatello, Ida.); westrumite (Hammond, Ind., Wichita, Kans.); untreated cedar block (Detroit, Mich.); iron ore (Iron River, Mich.); imperial (Kansas City, Mo.); cobblestone (Geneva, N. Y., Altoona, Pa., Reading, Pa., Danville, Va., Lynchburg, Va.); granulated slag (Kent, O., Scottdale, Pa.); bitustone (Nashville, Tenn.); bois d'arc block (Paris, Tex.); shale (Sheridan, Wyo.).

Sewage Sludge as Fertilizer

The use of sewage sludge as fertilizer was one of the subjects of which a study was made in 1923 by the Bureau of Sanitary Engineering of the Maryland State Department of Health. Experiments carried out, it is reported by Abel Wolman, chief engineer of the Bureau, indicate that "in a sewage sludge free to undergo normal digestion the typhoid fever bacilli will survive probably less than 10 days. The speed with which the typhoid and dysentery bacilli die depends upon the moisture content and reaction of the soil and upon the nature and abundance of other flora. In a dry or acid soil, either moist or dry, most of the pathogenic bacteria will die within ten days.

"It has not been possible to determine the length of time tuberculosis bacilli will survive in sewage sludge, because of the difficulties encountered in their isolation. They may have a greater viability than the water borne types. It is doubtful, however, that the tuberculosis bacilli would survive more than the 7 days digestion period established in the investigation. . . .

"The laboratory evidence of recent date would appear to indicate that, if sewage sludge is held in a sludge digestion tank for a period not less than 10 days, its application to the soil for fertilizer purposes might be carried out without detriment to the public health through the possible dissemination of vegetable borne disease."

This investigation was made in connection with the use of sludge from the Baltimore treatment plant, and regulations prepared for the use of it providing that only such sludge be delivered to farmers as has undergone digestion for at least ten days, that it be carted in watertight vehicles, used on ground only before the crops are planted and not brought into direct contact with growing vegetables; that a permanent record be kept by the city of all sludge taken, giving date, amount taken, by whom, and location of farm on which used. The city to make regular inspection of farms where sludge is used during use, and refuse further sludge to any one violating the regulations; and permit inspection of the records at any time by the proper authorities.

Dewatering Activated Sludge*

Apparatus and Methods Employed in the United States and Results Obtained in Operating and Test Plants

By Langdon Pearse †

The experience in the United States on dewatering activated sludge has been acquired principally in testing stations built at Chicago, (Tannery, Packingtown and Corn Products), Indianapolis, Milwaukee, Urbana, (Illinois State Water Survey) and New Britain, Conn., and at actual operating activated sludge plants at Houston (Texas) and Chicago (The Sanitary District) each of which have two plants in operation, (Table 1 and 2).

The difficulties of dewatering are chiefly due (1) to the physical condition of the solids which retain very tenaciously the water, (2) to the large volume of sludge to be handled and (3) to the importance of removing practically all the solids from the sludge.

Briefly the problem is to take a sludge containing from 98.5 to 99.5 per cent water and reduce the water content to 80 per cent or less, the resulting cake being then heat dried to a moisture content of 10 per cent. Various types of apparatus or treatment have been tried. These may be classified as follows:

Primary Removal of Water.

1. Air drying on prepared sand beds.
2. Filtering.
    1. Through fine wire mesh (Maclachlan).
    2. Through filtros plates.
    3. Through absorbent material.
3. Filtering with aid of additional pressure.
    a. Hydraulic pressure applied to liquid.
        1. Chamber or leaf filter press.
        2. Kelly filter.
    b. Hydraulic pressure applied to bags.
        1. Worthington.
        2. Berrigan.
    c. Vacuum filters.
        1. Rotary leaf or American.
        2. Rotary drum or Oliver.
4. Centrifuge.
    a. Intermittent.
    b. Continuous.
5. Flotation.
6. Spraying (Bailey).

Secondary Removal of Water.

1. Rotary Heat Dryer.
    a. Direct.
    b. Direct—Indirect.
    c. Steam.
2. Travelling Belt Dryers.

Activated sludge dewatering is not to-day a problem of finding suitable machinery so much as of properly conditioning the sludge itself. By

*Paper presented to the International Conference on Sanitary Engineering, held in London, July 7, 1924.

†Sanitary Engineer, The Sanitary District of Chicago.

TABLE 1
Data on Activated Sludge in the U. S.

Name	Plant Data: Aeration hours	Plant Data: Re-Aeration hours	Plant Data: Cu. ft. air per gal.	Sewage: Susp. matter p. p. m.	Sewage: B. O. C. p. p. m.	Effluent: Nitrates p. p. m.	Effluent: B. O. C. p. p. m.
Urbana	4 to 5	....	1.3	90 to 130	....	....	....
Indianapolis	†6	....	0.6 to 1.0	190 to 310	156	....	....
Milwaukee	†6	....	1.5	244	....	....	†...
Houston:							
North Side	2½	3½	1.6	192	176	1 to 16	....
South Side	3¼	4½	2.1	....	....	....	....
Chicago (Sanitary District):							
Packingtown	9	....	3.5	605	990	0 to 7	33 to 112
Tannery	10	....	3.0	350	300 to 400*	0 to 20	....
Corn Products	12	....	3 to 4	196	400 to 960	0 to 20	....
Calumet	4	....	0.8 to 1.0	66 to 90	70 to 100*	1 to 3	....
Des Plaines	4 to 5	....	1.2	142	122*	{4 to 12} {Avg. 8.9}	8.5 to 17

† Design basis. * 5 days at 20 deg. C.

TABLE 2
Data on Activated Sludge in the U. S.

Name	Sludge from Tanks: Per Cent. on Dry Basis: Fixed	Volatile	N	P_2O_5	Lb. per mil. gal.
Urbana	..	..	5.1	3	740 to 1150
Indianapolis	..	..	..	..	1152 to 1656
Milwaukee	37.1	62.9	4.64	2.3	2000
Houston	37.1	62.9	4.64	1.9	....
Chicago (Sanitary District):					
Packingtown	37.4	62.6	4.2	2.7	1900 to 2400
Tannery	50.6	49.4	2.2	..	2260
Corn Products	25	75	6.0	5.5	785
Calumet	..	..	4.5	..	400
Des Plaines	45	55	5.0	4	650

conditioning is meant both the control of the activated sludge process as well as any supplementary treatment given by adding chemicals with or without heat. A sludge from a system producing a well nitrified effluent (5 to 10 parts per million) works better than a sludge from a system producing a low grade effluent, (under 5 p.p.m.). The moisture content of the sludge also has a bearing on its behavior. At times it has proven advantageous at Chicago (Des-Plaines) to dilute the sludge with effluent or clean water to bring the water content above 98.0 per cent.

Precipitation or sedimentation have not proven very helpful, except to reduce the first bulk of water. Seldom has the sludge gone below 97 per cent in the Sanitary District experience.

The admixture of an inert material like fullers' earth to coagulate or hasten absorption has not proven successfully and may injure the fertilizer value of the sludge by dilution. The use of garbage tankage or screenings has been suggested, to add fibre. Screenings mixed in have proven somewhat helpful at Chicago, (Packingtown).

The Sanitary District has endeavored to press activated sludge without heat. Under the conditions at Calumet and DesPlaines with cold sludge, the use of sulphate of alumina (4 to 10 lb. per 1,000 gal. of 98.5 per cent sludge) has been helpful and far more beneficial than sulphuric acid, (3.8 to 5.3 cc. per gal.). At Milwaukee, acid with heat has proven most productive during cold weather but sulphate of alumina has been almost as useful. The experience to date indicates the necessity of actual trial of the sludge.

Winter vs. Summer Results.

At Milwaukee, considerable difference is reported in the behavior of the sludge in the presses, between winter and summer, which will be met by heating the sludge in the colder weather with a maximum heat in February of 155 deg. Fah. At Chicago the efficiency of the pressing has been but slightly less in winter than summer.

Comparison of Press Types.

The comparison of press types is dependent on the sludge to some extent. A comparison of the presses in use at Chicago may be of interest as typical.

Press of Filter	Filter area sq. ft.	Cake Produced Lb.	Cake Produced P.C. Moist	Cycle Hours
Simplex	1,815	4,400	78	7
Worthington	1,440	3,500	76	5
Berrigan	3,520	10,000	78	8
Oliver	495	1,400	80	per hour

Amount of Sludge.

The amount of sludge to be handled has varied.

	Chicago Des Plaines	*Calumet	Milwaukee
Period of Aeration	4.5-5	4	
Maximum	6.8		
Minimum	2.4		
Air cu. ft. per gal.	1.2	0.8 to 1.0	
Maximum	3.2		
Minimum	0.8		

*Handling raw sewage.

Settling, Gal. per sq. ft.			
Per 24 hrs.....	1,000	1,540	
Maximum	250		
Minimum	1,300		
Sludge, Gal. per mil. gal.	5,100	2,300	5,000 to 20,000
Per Ct. Moisture..	98.5	98	
Lb. per mil. gal.....	650	400	

Air Drying.

Except at Indianapolis air drying has not proven desirable. In the Sanitary District tests, the Packingtown sludges dried slower than Imhoff sludge, the latter requiring from 4 to 7 days. The best air-drying record to spadable condition being 7 days on activated sludge. At Indianapolis considerable amounts of fibrous material from packing houses and canneries are present.

Filtering.

Filtering through fine wire mesh, 30 to 60 meshes to the inch, and through paper mill felt has been tested by the Maclachlan Company as part of a process using SO_2 as a conditioning reagent. The reports so far are inconclusive. At Houston encouraging results were reported as against discouraging results at Pasadena. The paper mill device has been abandoned.

Filtering through filtros plates was tried by Prof. Bartow at Urbana, on a filtering wheel with and without a vacuum. The sludge appears to have stopped the surface pores. The experiments were abandoned.

Filtering through absorbent material such as garbage tankage has been tried at Chicago. The results indicate that the tankage acts as a sponge. Consequently the retention of the water negatived any result.

Filtering With Aid of Additional Pressure.

Additional pressure is created by hydraulic pressure applied to the liquid forcing it into the filter chambers or applied to the sludge in bags, and by vacuum on the effluent side of the filtering medium.

Where the hydraulic power is applied to the liquid, chamber or leaf filter presses have generally been employed. Various types of leaf have been tried at Milwaukee, using drainage surfaces made with grooves or pyramidal projections, and at Chicago (Buckley) with a perforated plate drainage against the bag (120 plates each 36 x 36 in.). Ribs were also provided. Working up to 120 lb. per sq. in. on a cake 1 inch thick, breakage of cloths has occurred.

In the Kelly press, the filtering cloths are stretched on a frame, and set inside a cylinder, which is filled with liquid and pressure applied. The filtrate passes out through the inside of the frame. The difficulty in this type has been to produce a dry cake.

Where hydraulic pressure is applied to bags, two types have developed, both invented by J. J. Berrigan, one called the Worthington with bags filled at the top, suspended between built up steel drainage sheets and squeezed by large platens worked by a toggle joint; the other the Berrigan, with bags filled from the bottom, suspended between built up drainage sheets of hard wood slats squeezed by pressure applied directly on the heads of the press. The Worthington press has been tried at Milwaukee. Both types are in use at Chicago (DesPlaines River), the Worthington press holding 18 bags on platens 5 x 8 ft., and the Berrigan Press holding 80 to 120 bags with platens 4 x 6 ft. The bags are filled and squeezed by dry pressure. When the cake has formed the bags are opened at the bottom. The cake drops out. The advantage of the latter form (Berrigan) is the ability to control the thickness of the press cake, and the direct squeeze, making a simple apparatus.

Vacuum Filters.

There are two principal types of vacuum filter on the market, differing largely in the method of supporting the filtering surface, in each case not quite half submerged. In the American filter, rotating leaves are used, supported on a heavy hollow shaft. The cloths are filled in by segments. This type is built up to 14½ ft. diameter with 8 discs. In the Oliver type, the cloth is stretched on a built up drum and held down by spirally wound wire. A vacuum is produced by suitable pumps on the effluent side of the cloth, so that as the wheel or drum slowly revolves through the sludge, the solids adhere to the surface. Steam or air under pressure may be introduced during a portion of the cycle on the under side of the cloth. The cake is ⅛ to ¼ inch thick with a moisture content higher than for the other presses. The Oliver filter at Chicago (Calumet) has a unit drum 11 ft. 6 in. in diameter by 14 ft. long.

Centrifuge.

So far the only tests made on centrifuges have been at Cleveland and Milwaukee. At Cleveland a few simple tests were made with an intermittent centrifuge, the sludge being placed in bags. At Milwaukee a continuous solid bowl type was tested of the Basco-ter-Meer type. This machine apparently lacked capacity to remove the solids when operating at any considerable production. When operated to produce quantity, the finer solids passed through and caused trouble in the system. A revised machine is expected for trial at Chicago (Calumet).

Flotation.

Flotation is an attempt with or without heat to coagulate and float the sludge to the surface for ready removal. At Fortworth on packing house sludge, small amounts of acid (sulphuric) proved very effective on cold sludge, producing remarkable coagulation, with an underlying clear liquid. Such results have not been duplicated elsewhere. However, acidulation with heat was tried experimentally by the Dorr Company at Urbana and New Britain with some success. Enough acid was used to produce an acidity of 25 parts per million. Heat was then applied to raise the temperature to 50 deg. C. The process requires accurate constant control and to date has not met favor, largely because the moisture content has not been reduced below a range from 85 to 90 per cent. (New Britain), or 90 to 93 per cent. (Milwaukee). At New Britain and Milwaukee large losses of solids were reported.

Secondary Removal of Water.

The preparation of the sludge cake for commercial distribution necessitates the reduction of the moisture below 10 per cent. and sizing material to pass through an 8 mesh sieve.

To reduce the moisture drying is available either by exposure to the air or by heat dryers. Air drying as such is practicable only on a very small scale with thin cake such as comes from the vacuum filters. Heat drying is practicable on a large scale with either the direct type (Buckeye at Houston) or the direct-indirect (Atlas at Chicago). In the latter the dryer shell is enclosed in brickwork. Air is admitted through parts on the dryer walls. The fuel used is generally coal, though oil is used at Houston. The dust is arrested by a cone bottomed settling tank or cyclone, followed at Houston by an air washer.

The control of the dryer is important to prevent balling of the material to be dried. In the Sanitary District installations the sludge cake is fed into a closed system, the wet cake being mixed by a worm with dry sludge. This reduces the moisture in the material entering the dryer below 40 per cent. When running the temperature is from 1100 to 1600 deg. F. at the inlet and from 250 to 300 deg. F. at the stack. So far the best test run has been an evaporation per pound of combustible of about 9 pounds of water, but when running the evaporation drops off, averaging under 5 pounds.

This apparatus is not run continuously, but is kept hot and only operated by day. Hence better results are expected on a large plant. Considerable balling results which necessitates grinding, either in a Williams (hammer) crusher or in a Brown (disc) mill. Experiments are proposed on shredding or disintegration to reduce or eliminate the balling.

Filter Cloths.

The filter cloth is varied by the individual preference of the various apparatus makers. In general, however, the trend is to the use of duck (about 13 oz. twill) on vacuum drum filters and of burlap (from 8 to 12 oz.) on bag filters and some plate presses. The burlap bags last from 30 to 45 days. The duck on the Oliver filter at Calumet has lasted about 30 actual working days.

Cost Data.

Cost data on the Sanitary District operations are not yet available, and as obtained would be of little value, because the apparatus installed has much greater capacity than is actually needed. Further the overhead of operating labor is greater for the same reasons. Labor saving devices available to a large installation were not installed to facilitate changes in methods and apparatus.

At present, however, the cost of manufacture is greater than the selling price of the finished product, $15 per ton. On a large scale the cost of manufacture may be brought below $15 per ton, as estimated at Milwaukee.

National Museum of Engineering and Industry

A "National Museum of Engineering and Industry" appears to be assured, one million dollars having been provided, and a campaign was started on July 10th for raising an additional nine million. The president of the new organization, with headquarters in the Engineering Societies Building, is Dr. Elihu Thompson, who on July 5th received the Kelvin Gold Medal from the Royal Society of London. The vice-presidents are Dr. Edward G. Acheson, Dr. Leo H. Baekeland and Dr. Edward Weston. H. F. J. Porter is secretary.

In cooperation with the Smithsonian Institute, the new organization is planning to erect on its grounds in Washington a building to house the original models and early inventions and the records of constructive achievement of pioneers, inventors and engineers in the development of transportation and industry. In addition to the central collection at Washington, special collections such as replicas of the historical exhibits will be placed at other points and machinery for modern processes will be placed in affiliated museums in industrial centers of every state.

To Investigate Pavement Reinforcement

C. A. Hogentogler, of the U. S. Bureau of Public Roads, has been granted leave of absence in order to conduct for the Advisory Board on Highway Research of the National Research Council, a fact-finding survey of the economic value of reinforcement in concrete pavements. This survey is to be national in scope, and will be conducted in cooperation with agencies interested in this important subject. It is proposed to cover the various soils, traffic and climatic conditions throughout the United States. Mr. Hogentogler has had fifteen years of experience in highway construction and highway research which well qualifies him to take charge of the present investigation.

Garbage Incinerators in New York

New York City has begun a program of incinerating its garbage, having recently put into commission the largest incinerator in the country and contracted for another. The former is at 56th street and the Hudson river, Manhattan; the latter at 139th street and the Harlem river.

The incinerator now in use is of the Deane type, with a guaranteed capacity of 210 tons of garbage and 90 tons of rubbish per 24 hours. It adjoins a city garage and electric power is furnished for this as well as the incinerator plant by means of steam generated in the incinerator operating two 100 k. w. turbine generator sets. The steam also drives thirteen blowers. The ashes and clinker are removed by scows, the volume being only 6 per cent. of that of the refuse incinerated and therefore requiring only 6 per cent. as many scows.

Day Labor, Culverts and Reinforcement

Final Instalment of Statistics Concerning County Highways, the First of Which Appeared in the April Issue. Forty-eight Percent of Counties Reinforce Concrete Pavements. Twenty-two Percent Are Doing All Road Work by Day Labor, Twenty-eight Percent None, and Fifty Percent More or Less Of It

State and County	Amount of Work to Be Done By: Contract	Day Labor	Materials Used for Culverts*	Kind of Reinforcement Used
Kentucky (Continued)				
Letcher	All	.....	Poured	.....
Lincoln	All	.....	.....	.....
Morgan	All	.....	None	.....
Nicholas	7 mi.	2 mi.	.....	.....
Owen	$650,000	$50,000 reconst.	Corrugated	.....
Rockcastle	8 mi.	2 mi. gravel, 7 mi. macadam	Poured & corr.	.....
Shelby	Very little	Maintenance	Poured & corr.	.....
Woodford	Reconstruct. & surfacing	Ditching & repairs	Poured, corr. & vit.	.....
Louisiana:				
Caddo	A little	$500,000	.....	.....
Evangeline	52 mi.	.....	Poured & conc. pipe	.....
Michigan:				
Alger	None	13 mi.	.....	.....
Alpena	All except	Earth roads	Poured & corr.	.....
Branch	All except	Maintenance	Poured, corr. & vit.	Bars, cent. joint
Cass	All	.....	Poured & corr	.....
Chippewa	20 mi. macadam	Gravel & maint.	.....	.....
Dickinson	All, county bids	Maintenance & county constr.	Poured & corr.	Wire mesh, center joint
Genessee	Nearly all	Very little	Poured & conc. pipe	60-74 lb. per sq.
Gladwin	All	.....	None	.....
Houghton	11 mi. construct.	Maintenance	Poured & corr.	.....
Ionia	All except	Maintenance	None	½" & ¾" round bars
Kalamazoo	14 mi. concrete and macadam	12.5 mi. gravel & bit. concr.	Corrugated	.....
Kent	All	.....	Poured	State highway standard
Keweenaw	None	All	.....	.....
Lapeer	All	.....	Poured & conc. pipe	.....
Luce	None	All	Pipe	.....
Macomb	$875,000	$125,000	Poured	40 lb. wire mesh
Ottawa	All	.....	Poured & vit.	.....
St. Joseph	All	.....	Poured & corr.	State specifica.
Van Buren	All	.....	Vit. & corr.	Center plate & rods
Wexford	All	.....	.....	Center joint & dowels
Minnesota:				
Aitkin	None	32 mi.	Corr. & concr. pipe	.....
Benton	3 mi. grading	12 mi. grading	Poured, corr. & sectional concr.	.....
Blue Earth	17 mi. grading	15 mi. grading, 20 mi. gravel	Poured & corr.	.....
Brown	50%	50%	Poured, corr. & sectional concr.	.....

State and County	Amount of Work to Be Done By: Contract	Day Labor	Materials Used	Kind of Reinforcement Used
Montana:				
Chouteau	10 mi.	.....	Corrugated	.....
Dawson	.....	.....	Poured	.....
Fallon	None	.....	Corrugated	.....
Fergus	None	All	Corr. & concr. pipe	.....
Golden Valley	.....	All	.....	.....
Judith Basin	.....	All	Corrugated	.....
Missoula	All except	Maintenance	Corrugated	.....
Prairie	None	All	Creosoted timber	.....
Roosevelt	.....	All	Corrugated	.....
Sheridan	None	Grad..surfacing	Corrugated	.....
Nebraska:				
Butler	10 mi. grading	10 mi. grading	Corr. & concr. pipe	.....
Gosper	None	All	Wood & galv. iron	.....
Knox	All except	Maintenance	Poured & corr.	½" rods
Lancaster	All except	150 mi. grading	Poured	.....
Morrill	All except	Maintenance	Corrugated	.....
Nance	None	All	Concr. pipe	.....
Otoe	All	.....	.....	.....
Pierce	All	.....	Poured & corr.	.....
Polk	$20,000	$30,000	Poured	.....
Richardson	$35,000	$140,000	Poured, corr. & concr. pipe	.....
Sarpy	All	.....	Corrugated	.....
Sherman	None	All	Iron	.....
Valley	.....	.....	Corrugated	.....
Nevada:				
Esmeralda	None	.....	Wood	.....
New York:				
Broome	None	15 mi. mac.	Concr. pipe	.....
Cayuga	All of state	27 mi.	Poured & concr. pipe	.....
Chautauqua	State system	15 to 25 mi.	.....	.....
Jefferson	$300,000	$300,000	Poured & concr. pipe	½" bar
Livingston	.....	.....	Cast iron	.....
Madison	None	All	Poured & concr. pipe	.....
Niagara	All	None	Poured & c. I. pipe	.....
Oneida	.....	.....	Poured & c. I. pipe	.....
Orleans	5.3 mi. state	9.25 mi. county	Poured	.....
Schuyler	None	All	Poured, corr. & concr. pipe	.....
Suffolk	50%	50%	.....	Bars, 54 lb.
Sullivan	None	All	.....	.....
Tompkins	All	.....	Poured	.....
Yates	All state	5 mi. by towns	Poured & corr.	.....
North Carolina:				
Burke	None	All	Corr. & concr. pipe	.....
Columbus	.....	All county work	None	.....
Madison	None	All	Poured & concr. pipe	.....

Carlton ..... 5 mi. gra...

Carlton	5 mi. grading and gravel	21 mi. grading	Poured, corr. & concr. pipe	Parallel rods at edges
Carver	All	.....	Poured, corr. & concr. pipe	.....
Chippewa	15 mi. grading	15 mi. gravel.	Poured, corr. & concr. pipe	.....
Chisago	8 mi.	12 mi.	Poured & corr.	.....
Clay	12 mi.	35 mi.	Corr. & concr. pipe	.....
Clearwater	All	.....	Corrugated	.....
Cook	None	All	Corrugated	.....
Cottonwood	None	All	Corr. & concr. pipe	.....
Dakota	All	.....	Poured, corr. & conc.	.....
Dodge	All	None	Poured, corr. & sectional concr.	.....
Faribault	None	All	Poured & corr.	.....
Freeborn	None	.....	Corrugated	.....
Goodhue	5 mi. grading	25 mi. gravel.	.....	.....
Grant	All	.....	Corr. & concr. pipe	.....
Hennepin	50%	50%	.....	.....
Houston	5 mi.	.....	Poured & corr.	.....
Hubbard	All	.....	Corr. & concr. pipe	.....
Isanti	50%	50%	Metal pipe	.....
Jackson	22 mi. grading, 12 mi. gravel.	20 mi. grading	Poured & conc. pipe	.....
Kandiyohi	All	.....	Corr. & sec. concr.	.....
Koochiching	None	All	Corrugated	.....
Lac Qui Parle	None	All	Concr. pipe	.....
Lake of Woods	$15,000	$29,000	Corrugated	.....
Lincoln	$46,000	$9,000	Poured & corr.	.....
Lyon	All	.....	Poured & sec. concr.	.....
McLeod	All	.....	Poured & corr.	.....
Mahnomen	All except	Maintenance	Corrugated	.....
Marshall	Grading	Maintenance	Corr. & concr. pipe	.....
Martin	All	.....	Poured & corr.	.....
Meeker	....	.....	Poured & corr.	.....
Mower	.....	Grad. 54.5 mi.	.....	.....
Murray	30 mi.	12 mi.	Poured, corr. & sectional concr.	.....
Otter Tail	$350,000	$150,000 maintenance	Poured, corr. & concr. pipe	.....
Pine	....	All	Corrugated	.....
Redwood	20 mi. gravel.	5 mi. grading	Poured & corr.	.....
Rice	All except	Maintenance	Poured & corr.	.....
Rock	12 mi. grading, 16 mi. gravel.	13 mi. grading & maintenance	Corr. & concr. pipe	.....
Roseau	All	.....	Poured & corr.	.....
Sherburne	All except	Blade work	Corr. & conc. pipe	.....
Sibley	91%	9%	Corr. & conc. pipe	.....
Steele	None	All	Poured & corr.	.....
Todd	None	.....	.....	.....
Waseca	Grading	Graveling	Corr. & conc. pipe	.....
Washington	None	Maintenance	.....	.....
Watonwan	All	.....	Corr. & concr.	.....
Wilkin	All	.....	Corrugated	.....
Wright	All	.....	Corr. & concr.	.....
Mississippi:				
Madison	All	.....	Poured & corr.	.....
Missouri:				
Buchanan	All	.....	Concr. pipe	.....
Callaway	.....	All	Poured & corr.	.....
Clark	All state	30,000 gravel	Poured, corr. & concr. pipe	.....
Clinton	All	.....	Poured, corr. or wood	.....
Cooper	None	All	Poured & corr.	.....
Holt	All over $500	Maint. & repairs	Poured & corr.	.....
Marion	None	All	Poured & corr.	.....
Mississippi	All	.....	Poured	.....
Pettis	.....	$70,000	Poured & corr.	.....
Randolph	All	.....	Poured	.....
St. Clair	.....	.....	Corr. & vit.	.....
Saline	None	$40,000	.....	.....
Wayne	None	All	Poured	.....

*The abbreviations stand for concrete poured in place, cast iron, corrugated iron, vitrified clay pipe, and concrete pipe.

Onslow	None	All	None	.....
Person	.....	10 mi.	Poured, corr. & concr. pipe	.....
Sampson	State work	County work	Corr. & concr. pipe	.....
Wilson	$290,000 concr.	$80,000 top soil	Poured & corr.	.....
North Dakota:				
Barnes	All	.....	Corrugated	.....
Hettinger	All	.....	.....	.....
McLean	Graveling	Reshaping	Poured & corr.	.....
Nelson	All	.....	Corr. or concr. pipe	.....
Pierce	None	Township work	Galv. corr.	.....
Traill	All except	Reshap. 80 mi.	.....	.....
Ohio:				
Ashtabula	.....	All	Poured	Bars, 45 lb.
Carroll	4 mi. primary	Second. county	Poured & vit.	.....
Clinton	All	None	Poured, corr. & vit.	.....
Crawford	All	None	Poured & c. i.	.....
Defiance	All	.....	.....	.....
Erie	All except	$15,000	.....	56 lb.
Fulton	All except	Maintenance	Poured & concr. pipe	Bars, 35 lb.,
Holmes	All	None	Poured, corr. & c. i.	.....
Madison	All	None	Poured	.....
Medina	4.9 mi.	Resurfacing & repairing	Poured & corr.	.....
Paulding	All	None	.....	.....
Pickaway	3 mi. brick & macadam	14 mi. gravel	.....	.....
Preble	All	.....	.....	.....
Putnam	All	None	Poured	¾" & ½" sq. tw. bars
Sandusky	12.5 mi. brick & macadam	20 mi. surface treat.	Poured	56 lb. mesh
Shelby	4 mi.	$100,000	.....	.....
Stark	Nearly all	Very little	Poured & concr. pipe	Illinois type
Warren	10 mi. mac.	8 mi. mac. & maintenance	Poured & corr.	.....
Wyandot	All except	Maintenance	Corr. & c. i.	.....
Oklahoma:				
Atoka	$20,000	$50,000	Poured	.....
Blaine	6½ mi.	10 mi.	Poured & corr.	½" 85 lb.
Caddo	None	All	Poured, galv. & vit.	.....
Coal	Very little	.....	Corrugated	.....
Creek	All	.....	Poured	.....
Harmon	Bridge	All other	Poured & corr.	.....
Jackson	Graveling	50 mi. blade grad.	Poured & vit., clay or corrugated	.....
Kingfisher	Approx. 75%	25%	Poured	None
Latimer	9 mi.	15 mi. earth rd.	Poured & rein. concr. pipe	.....
Okfuskee	All except	Maintenance	Poured	.....
Tillman	Culv. & bridges	Road dragging & mountains	Poured	.....
Oregon:				
Clatsop	All pav., small grad. jobs	5 mi. heavy grading	Vit. & concr. pipe	None
Douglas	Approx. 8 mi. grad.; 3 bridges	Approx. 12 mi. grading	Poured & corr., rein. concrete	None
Marion	None	All	Concr. & corr.	.....
Morrow	None	All	Corrugated	None
Sherman	Com. grading, rock haul	Rock excav., crush. & bridg.	Poured & corr.	.....
Wallowa	All but market road	Maintenance	Corr. or concr.	.....
Yamhill	None	All but state highway	Poured & rein. concr., corr. & concr.	.....
Pennsylvania:				
Erie	All	.....	Poured	.....
Indiana	All concrete	All macadam	.....	.....
Jefferson	All	None	.....	.....
Lackawanna	All	None	Concr. pipe	.....
Northampton	All	None	.....	.....
Warren	All	None	Poured	.....

DAY LABOR, CULVERTS AND REINFORCEMENT (Continued)

State and County	Amount of Work to Be Done By: Contract	Day Labor	Materials Used for Culverts*	Kind of Reinforcement Used
South Carolina:				
Cherokee	None	All	Corr. & concr. pipe	.....
Greenwood	All except	Maintenance	Poured & concr. pipe	None
Marlboro	Nearly all	.....	.....	.....
Newberry	All		.....	.....
Orangeburg	$400,000 if bond issue carries	$150,000	Poured & concr. pipe	.....
Pickens	$130,000	$90,000	.....	.....
Union	17 mi.	12 mi.	Corrugated	.....
South Dakota:				
Buffalo	F. A. P. by state hwy., 20 mi.	Earth grad. & culvert	Corrugated	None
Douglas	None	All	Corrugated	.....
Faulk	64 mi.	10 mi.	Poured & corr.	.....
Jackson	Graveling	Grading	Poured & iron	.....
McCook	Bridges	Grading	Corr. pipe	.....
Pennington	75%	25%	Poured & corr. & concr. pipe	.....
Potter	None	All	Corr. & concr. pipe	.....
Roberts	None	All	Poured & corr. & concr. pipe	None
Yankton	All	None	Poured & concr. pipe	.....
Tennessee:				
Chester	19.03 mi.	None	Corr. iron	.....
Cocke	Approx. ½ by state	½	Poured & corr.	.....
Cumberland	15 mi.	.....	Armco	.....
Grundy	All not let	None	Poured & corr.	.....
Hawkins	All	.....	Poured	.....
Jackson	.....	$7,000 auto fund	.....	.....
Knox	Most of it	.....	Poured & concr. pipe	.....
Rutherford	32 mi.	65 mi.	Poured	.....
White	All	.....	Poured & vit.	.....
Texas:				
Anderson	All	.....	Poured & concr. pipe	¾" round & ½" square
Angelina	All	.....	Poured & corr.	.....
Aransas	All	.....	.....	.....
Brewster	Nearly all 1st class	Practically all secondary	Poured	.....
Cameron	$150,000	$50,000	Poured, corr. & vit.	Bars
Carson	.....	All dirt work	Poured & treated pine	.....
Coleman	All	None	Poured	.....
Collin	All	.....	Poured	Bars, 3' centers
Colorado	Old contracts	Dirt roads	None	.....
El Paso	$1,700,000	$150,000	Poured & corr.	.....
Galveston	$30,000	$110,000	Creosoted lumber	.....
Gonzales	All except	Maintenance	Poured	.....
Guadalupe	All except	30% if bonds carry	Cast iron	.....
Hunt	All	.....	Poured	.....
Jim Wells	$1,000,000 concr. & bit. mac.	$10,000 dirt	Poured	.....
Johnson	All	None	Poured	.....
Orange	All	None	Poured	Bars
Parmer	All	.....	Poured	.....
Potter	All	None	Poured	Bars
San Patricio	All	None	Poured	.....
Smith	20 mi. gravel	20 mi. asphalt surface	Poured	.....
Somerville	All	None	Poured	.....
Uvalde	20 mi. state highway	22 mi.	Poured & vit. or c. i.	.....
Ward	All	.....	Poured	.....
Wilson	All	None	Poured & corr.	.....
Vermont:				
Orange	F. A. bridges	S. A. & maintenance	Corrugated	.....
Virginia:				
Halifax	None	All	.....	.....
Pittsylvania	5 mi. soil & bridges	Maintenance	.....	.....
Tazewell	$65,000	$35,000	.....	.....
Washington:				
Adams	All except	Maintenance	Poured & conc. pipe	.....
Benton	5 mi., $17,800	$95,752	Poured, corr., vit. & concr. pipe	.....
Clallam	20 mi.	10 mi.	Concrete pipe	.....
Ferry	10 mi.	None	Concrete pipe	.....
Franklin	$35,000	$55,000	Poured & corr.	.....
Island	2 mi.	2 mi.	Concrete pipe	.....
Jefferson	$218,000	$60,000	Poured, corr. & concrete pipe	.....
Lincoln	23 mi. grade and gravel	12 mi. grade and gravel	Corr. & concr. pipe	.....
Pend Oreille	All except	County roads	Concrete pipe	.....
Snohomish	All	.....	Poured	.....
Spokane	80 mi. county, 18 mi. state	1 mi. & bridge maintenance	Poured, corr. & concrete pipe	.....
Wahkiakum	.....	.....	Corrugated	.....
Whatcom	$25,000	$100,000	Concrete pipe, cedar logs	.....
Whitman	23 mi. mac., 5 mi. concr.	17 mi. mac.	Poured, corr. & concrete pipe	⅜" rods
West Virginia:				
Boone	All	.....	Poured	.....
Cabell	All except	2 mi.	Vit. & concrete pipe	40 lbs. per sq.
Greenbrier	4.5 mi. grading	All surface work	Corrugated	.....
Mineral	4.5 mi. bit. mac.	All other	Concr. & c. i. pipe	.....
Monongalia	All	.....	Concrete pipe	70 lbs. per sq.
Monroe	All except	Maintenance	Poured, corr. & vit.	.....
Morgan	60%	4 mi.	.....	.....
Pocahontas	All except	5 mi. gravelling	Poured & conc. pipe	.....
Upshur	All	.....	Poured	.....
Wisconsin:				
Adams	None	All	Corrugated	.....
Bayfield	4 bridges	All other	Corrugated	.....
Calumet	2 mi. concrete	Grading and surfacing	Poured & corr.	½"
Dane	75%	25%	Poured	Dowel bars
Door	.....	Nearly all	.....	½"
Florence	None	All	.....	.....
Grant	$20,000	$216,000	.....	.....
Jefferson	50%	50%	Poured	.....
Juneau	Bridges	All other	.....	.....
La Crosse	None	All	Corrugated	.....
Langlade	None	All	.....	.....
Marinette	None	All	Poured & corr.	.....
Milwaukee	All	.....	Poured	.....
Oconto	None	All	Corrugated	.....
Richland	None	All	Poured & corr.	.....
Shawano	None	All	Poured & corr.	.....
Trempealeau	50%	50%	Poured & corr.	.....
Vernon	None	All	Poured & corr.	Mesh
Waukesha	5 mi. concrete	30 mi. gravel	Poured	⅝"
Wyoming:				
Big Horn	None	None	Corrugated	.....
Campbell	All except	Tractor grading	Corrugated	.....
Crook	$70,000	$20,000	.....	.....
Sheridan	All except	Maintenance	Corrugated	.....

*The abbreviations stand for concrete poured in place, cast iron, corrugated iron, vitrified clay pipe, and concrete pipe.

Recent Legal Decisions

REQUIREMENT AS TO LETTING PAVING CONTRACT TO LOWEST BIDDER VIOLATED BY AFTERWARDS BARTERING FOR ELIMINATION OF THE FREEZING CLAUSE

The Arizona Supreme Court holds, Southern Surety Co. v. City of Prescott, 221 Pac. 834, that a paving contract, when finally executed and delivered under the Arizona Code, pars. 1953-1977, was beyond the power of any one to change or modify; and the superintendent of streets, a ministerial officer, vested with no discretion in the premises, could not modify the contract, or extend any exemption, privilege or immunity to the contractor, with or without consideration.

The law under which the contract was made provides that the work shall be let to the lowest bidder. The bids for the doing of this work were invited and made and received upon the basis of specifications containing a freezing clause. After all the other bidders had been eliminated, the superintendent of streets undertook to barter with the successful bidder for the elimination of this element of expense in consideration of the payment of upwards of $4,700. It did not appear how much the other bidders estimated the hazard entailed by that clause. Nobody knew whether the work might have been done with that clause eliminated for $3,000, $4,700 or $5,700, or $10,000 less, or whether the $4,700 represented more or less than some other bidder would have paid for the same privilege. The court said: "Such a transaction destroys the whole plan of having work done by the lowest bidder; the only plan which protects the property owner from improvidence and fraud. There is no intimation and no doubt but what in this instance the officer acted honestly and conscientiously, though ill-advisedly and unlawfully; but the method he employed is one which might be used by an unscrupulous officer with a great loss and damage to the property owners, and is prohibited by statute."

BURDEN OF EXPENSE OF HARD - SURFACED ROAD ALONGSIDE CORPORATE LIMITS AND BUILDING BRIDGE THEREON

The Kansas Supreme Court holds, Board of County Comrs. of Mitchell County v. City of Beloit, 220 Pac. 1020, that, under the provisions of section 2 of chapter 218, Kansas Laws of 1921, which provides, "When a benefit district hard-surfaced road is constructed alongside the corporate limits of any city, the city shall pay 50 per cent of the cost of construction thereof," etc., a Kansas city of the second class is liable for 50 per cent of the cost of construction of a hard-surfaced road alongside its corporate limits where the corporate limits extend to the middle of such road.

Under section 11 of chapter 265 of the Kansas Laws of 1917, providing that "all bridges, the cost of which exceeds $2,000 and all bridges of twenty-foot span or greater, which are required in making the improvements herein provided for, shall be built by and at the expense of the county under the general laws of the state relating to the construction of bridges," the county is bound to bear the entire expense of constructing a bridge which costs more than $2,000, constructed on a hard-surfaced road alongside the corporate limits of a city.

ABANDONMENT OF MUNICIPALLY OWNED PUBLIC UTILITY PLANT WITHOUT SUBMISSION TO VOTE

The Oklahoma Supreme Court holds, Moomaw v. Lions, 220 Pac. 865, that a portion of the property bought with the proceeds of a bond issue for the construction of an electric plant for an incorporated town may be abandoned by the board of trustees of the town when it becomes unsuitable or unprofitable to use it for the purposes for which it was originally intended, and it is not necessary to have an election for that purpose. A contract entered into by the board for the purchase of electric current to supply the town's electric light system, which results in the practical abandonment of the plant which had theretofore been operated for generating electricity, and which plant had been purchased with the proceeds of a bond issue, is not invalid because the execution of the contract and the abandonment of the light plant was not submitted to a vote of the people.

NOT ESSENTIAL THAT STATE ROAD SHOULD BENEFIT WHOLE PUBLIC OR CONNECT WITH A HIGHWAY

The Oregon Supreme Court holds, Moody v. Benson, 220 Pac. 561, that it is not essential to the exercise of the powers of the State Highway Commission, in the adoption and improvement of a state road, that the use or benefit shall extend to the whole public or to any considerable portion thereof, nor does the exercise of these powers depend upon the length of the road or the number of persons through whose land it may pass. The establishment and improvement of such a road is a matter entirely within the discretion of the Commission. The objection that the terminus of the road does not connect with the public highway or a place of public resort does not deprive it of the character of a public road, or invalidate the proceedings for its establishment.

ROAD CONSTRUCTION—PROCEDURE WHERE FUNDS INSUFFICIENT FOR ALL THOSE AUTHORIZED

Holding that road commissioners may complete those roads which they consider will serve the greatest number of people where the proceeds of the authorized bond issue are insufficient to macadamize all the roads enumerated in the resolution therefor, the Tennesse Supreme Court, in Crye v. Monroe County, 255 S.W. 46, says: "The theory of all improvements of a public nature is the greatest benefit to the greatest number. Among those who are expert in the science of road building it is generally con-

ceded that it is better to have one completed highway, and that more people are served thereby, than to have two highways only half completed. This is the system upon which highway construction is being carried on in the more progressive states."

FAILURE TO GIVE NOTICE OF INJURY FROM DEFECT IN STREET NOT EXCUSED WHERE PLAINTIFF NOT INCAPACITATED THE WHOLE OF THE TIME LIMIT

The Nebraska Supreme Court holds, Harris v. City of Genoa, 195 N. W. 953, that where a person injured in an accident on a street, who seeks to recover damages from the city, was mentally and physically able to direct or procure the giving of the notice required by section 4384, Nebraska Comp. St. 1922, for at least two weeks of the thirty-day period allowed by the statute, the fact that she became incapacitated on the twenty-seventh day after the accident does not excuse her failure to give notice in proper time.

SUFFICIENCY OF NOTICES BY VILLAGE TO TERMINATE SEWAGE DISPOSAL PLANT CONSTRUCTION CONTRACT

A contract for the construction of a sewage disposal plant for a village provided that if the contractor "failed in any respect to prosecute the work with promptness and diligence," the village might, after five days' notice, take over and complete the work at the contractor's expense. The contract provided that pumps and screens with sufficient piping should be completed by December 15, 1922, and the whole work completed by April 15, 1923. On October 14, 1922, the village served on the contractor a five-day notice to terminate the contract under the provision quoted. The contractor, in two actions for damages, one for unlawful ouster from the work and the other for the village's taking possession of its materials and equipment, contended that the notices served were defective and insufficient for the reason that they did not point out in what respect the contractor was failing to supply a sufficiency of men and materials, the reason given in the notices for terminating the contract. The New York Appellate Division holds, Faillace v. Village of Mamaroneck, 202 N. Y. Supp. 115, that the notices were sufficient without more particularly pointing out the default.

REGULATIONS FOR SNOW CLEARING BY STREET RAILWAYS IN MASSACHUSETTS

The Massachusetts Department of Public Utilities, which has power to amend the snow-clearing regulations of cities in any reasonable way so long as the general intent of the law is carried out, amended the regulations of the city of Northampton, so as to provide that street railway companies which have cleared snow from their tracks, should remove such snow as is deposited on sidewalks or crosswalks; and where it is deposited in the streets the companies should either remove it or level it in such a way that the streets may be reasonably safe and convenient for travel. The only other obligation the Department thought could be properly placed upon the street railway companies would require such companies to remove the snow cleared from their tracks in such streets as the local authorities themselves clear of snow.

CONSTRUCTION OF GOVERNMENT CONTRACTS—CONTRACTOR NOT A TRUSTEE

In an action by the government to recover an alleged overpayment on a contract for construction of an army camp on the cost plus plan, the government took the position that as between it and the defendant contractor a fiduciary relation existed—that defendant's position was that of a trustee and that of the government the beneficiary of a trust. On this point the Federal District Court for Southern Ohio, Sater, D. J., in United States v. A. Bentley & Sons Co., 293 Fed. 229, said: "It is true the courts have regarded government officers and agents, when dealing for or with the government to which their services are due, as occupying a position similar to that of a guardian transacting business for or with his ward. It is also true that persons dealing with government officers and agents, whether such officers or agents represent a municipal, a state, or the national government, are in duty bound to inquire as to and to take notice of the extent of such officers' and agents' authority and power and are to be held to a recognition that such officers and agents must observe fairness and good faith as between themselves and the government and may not be swayed to the prejudice of the interests of their cestui que trust. Both are expected to exercise honesty and common sense. But no cases have been found which hold that a person who is not an officer or a representative of the government occupies in dealing with it the position of or a position akin to that of a guardian or trustee. When the government enters into a contract with an individual or corporation, it divests itself of its sovereign character as to that particular transaction and takes that of an ordinary citizen and submits to the same law as governs individuals under like circumstances. . . .

"The government's contracts are to be interpreted the same as those between individuals to ascertain the intent of the parties and to give them effect accordingly, if that can be done consistently with the terms of the agreement. A contract couched in the language of the government's own officers (and such is said to be true of the contract in question) is construed most strongly against it, as in the case of an individual whose contract is framed in his own language."

It was therefore held that a trust did not arise by virtue of a paragraph in a cost plus contract by which the contractor agreed "at all times to use its best efforts in all its acts hereunder to protect and subserve the interest of the contracting officer and the United States."